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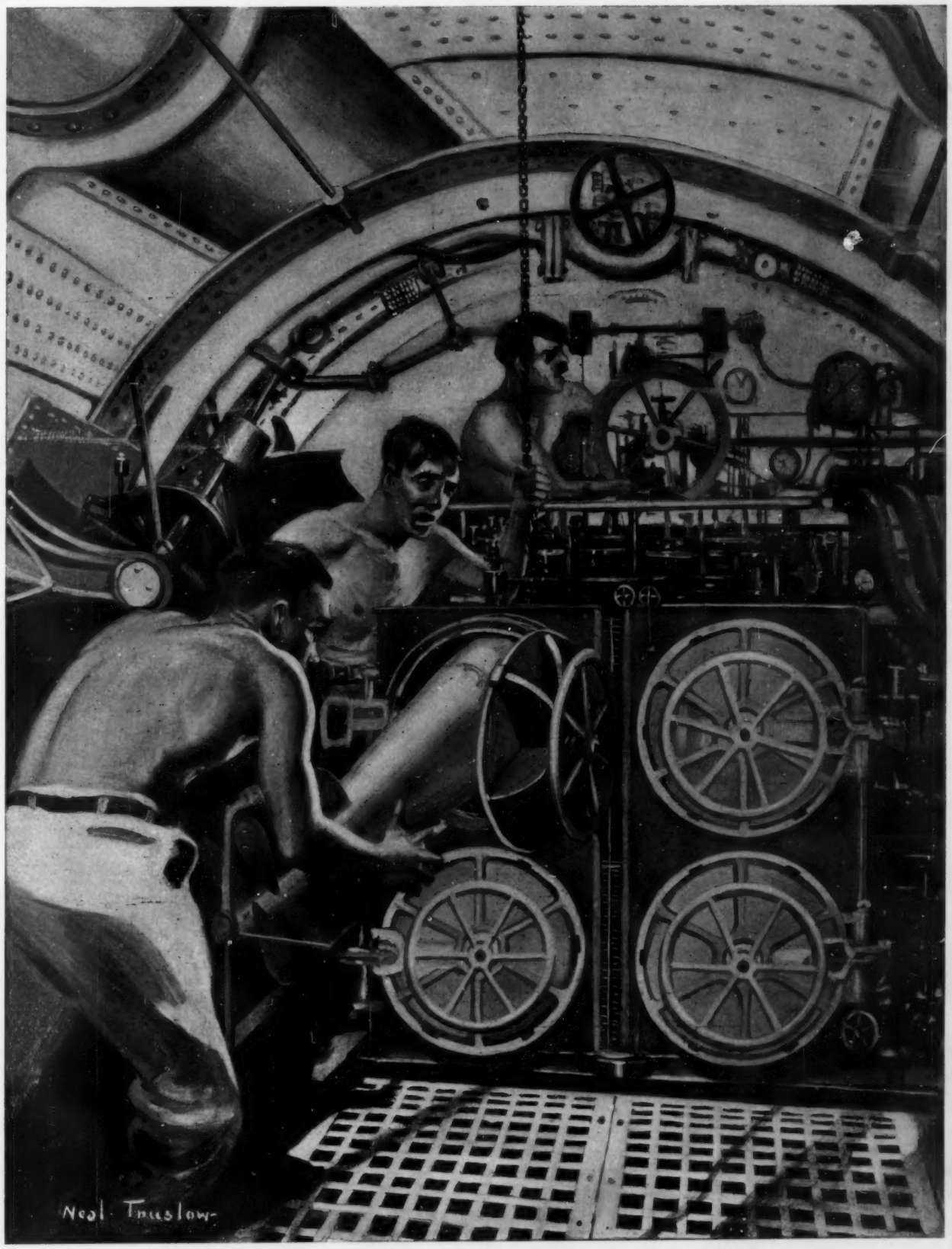

LOADING A TORPEDO INTO ONE OF THE FOUR FORWARD TUBES OF A SUBMARINE.—[See page 493.]

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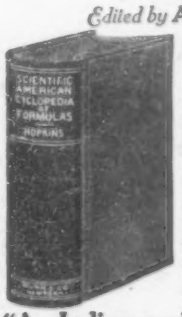

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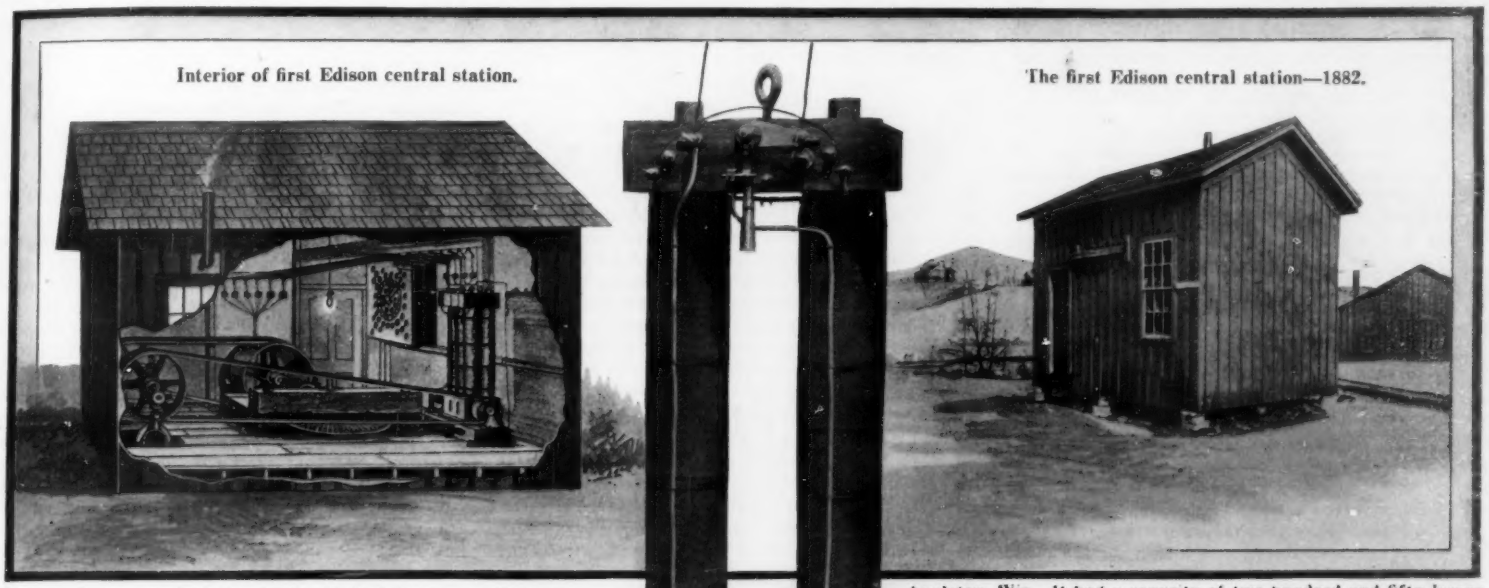


Interior of first Edison central station.

The first Edison central station—1882.

This earliest central station in the United States was built in Appleton, Wis. It had a capacity of two hundred and fifty lamps.

When Electricity Was Really in Its Infancy

By Prof. Francis B. Crocker

DR. WHEELER and I first turned our attention to electricity about 1874, which was forty years ago. Of course it was only the play of two boys who had the same bent, but we actually began to make crude forms of electric batteries, etc., at that time.

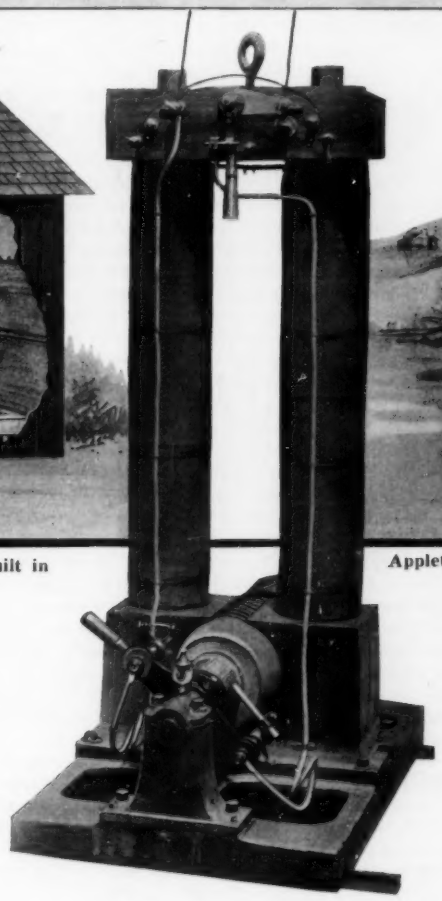
In the early days general knowledge of electricity was very limited. Few persons, in fact, not one in 10,000, knew anything about the subject. Even the books were largely confined to frictional or static electricity. For many years after that time there was a general notion that the dynamo acted by friction.

Quantitative ideas were particularly vague. For example there were no voltmeters or ammeters. During my career there have been three different kinds of ohms and volts with somewhat different values, that is, the B. A., Legal and International ohms. One inventor whose ideas were submitted to me claimed that his dynamo generated *better quality* of electricity which would produce more light, although it did not measure more; the same way that better quality of coal would produce more steam per pound burned under a boiler.

When we first began to study electricity, the telegraph was the only practical application. It was before the telephone was invented or any commercial forms of dynamo-electric generator or motor; arc or incandescent lamps; electric railway; power transmission or electro-chemical apparatus were used or even seriously considered. At that time the only important electrical plant in New York city was the main Western Union Telegraph Office on Broadway at Dey Street, in which one whole floor was filled with cells of gravity battery. The maximum output was about one eighth watt per cell, and there were, I think, 20,000 cells, which would give a total of 2½ kilowatts. Yet that was the largest electrical generating plant in commercial operation in America!

The telephone was first exhibited at the Philadelphia Exposition in 1876. The first ones that I ever saw were those we made ourselves from descriptions in the SCIENTIFIC AMERICAN. For a long time the telephone was regarded as merely an interesting toy. A friend of ours who owned the exclusive rights for New York city and vicinity sold them for $20,000, and thought he had done well.

The first arc lamps were those of Brush, Weston, and Thomson-Houston. I remember that one of the first practically used in New York was in the Equitable Building, where it was visited by thousands as a great curiosity. The "sub-division of the electric light" had been a great bugbear until Brush was able to run a number of arc lamps in series on the same circuit, without interference between them. Before that time each lamp had to have its own generator! How would the New York Edison Company like to operate on that plan to-day?



Edison dynamo of 1883.

I remember very distinctly that I saw at Menlo Park the first successful incandescent lamp ever produced. There were only a few of them in Edison's laboratory. They could all have been easily put in a small basket. When they were brought out publicly they created a great sensation, and the gas stocks tumbled in price to the extent of millions of dollars throughout the country, and the Edison Company's stock went up to $2,500 per share; that is, twenty-five times the par value. They reached this enormous figure on the theory that the Edison stock had gained all that the gas stocks had lost! Edison "sub-divided" the electric light by putting his incandescent lamps in parallel. He devised the safety fuse, but at first it was single pole, that is in one wire only. At that time the sockets, switches, and fuse blocks had wooden bases which were so many pieces of kindling wood for starting fires. The so-called "underwriter's wire," then generally used, was miserably insulated and for that reason soon came to be known as "undertaker's wire."

For a long time the generators were all bi-polar even up to 100 kilowatts or more. With the exception of a very few so-called "Jumbo" Edison machines they were high speed and belted.

Long after electric lighting started there were practically no motors. Central stations objected to having them on their circuits for fear of affecting the lights. It took years to overcome this prejudice. To-day the motor load is considered much more desirable than the lighting load because it lasts longer and is more nearly constant. Motors began to be used commercially just about the time the Crocker-Wheeler Company was started in 1888, which was about ten years after electric lighting was introduced. At first it was hard to convince people of their value. People would ask, "Why turn the mechanical power of steam, gas or water into electricity and then back again into mechanical power?" That simple question seemed almost unanswerable.

When each new application of electricity came out, and for applications in general, the public has always taken the wrong view or applied the wrong test. The new way was expected to be *cheaper* immediately, and nearly every one thought that the whole story. In point of fact electric lighting from central stations cost more than gas light up to the advent of tungsten lamps, certainly more than from kerosene oil. Convenience, cleanliness and many such advantages are really the reasons why it was preferred. The same is true of electric motors. Each new application of electric drive had to overcome the same old opposition. Apparently there was no great advantage in cheapness, and few could see the other fifteen merits which are really more important. Even if it was successful for other service each man thought that it was not good enough for the peculiar conditions of his particular work. This was notably true of carpet and silk looms. It was awfully hard to get people to try the first motor, but in a year or two you could not take away their electric drive for love nor money. The first induction motors were described in Tesla's paper at the A. I. E. E. meeting in May, 1888. I remember distinctly seeing there the only induction motors in the world—two small specimens lying on the table. Tesla did not invent the polyphase system or generator, or even the rotary field. Deprez in 1883 laid down the theory. Charles S. Bradley applied for a patent in May, 1887, a year ahead of Tesla. This patent covered too a rotary converter and the double-current machine, that is, it may be employed as a double-current, single or polyphase generator or motor.

The electric railway also came in about that time, that is, 1888 and 1889. At first there was much trouble with burning out of motor armatures. I remember that in one case a man in charge of repairing them was asked if they did not often burn out. He answered "Oh, no, only three to-day," and it was then about noon! In all the earlier forms of electric motors, even those used for traction, the working parts, coils and connections were much exposed, with little or no protection. The partly and wholly inclosed types of machine were not generally adopted until ten or fifteen years after motors had been in commercial use.

I was present when the first important power transmission system in the country was started. The power was generated at Niagara Falls and transmitted to Buffalo, the line being less than twenty miles long, but it was considered long distance transmission. The pressure used at first was 11,000 volts, which later was raised to 22,000 volts. The former voltage ranked as the highest in the world at that time in commercial service, and was regarded as so extraordinary that all sorts of precautions and special arrangements were required to handle it. It seemed to involve as many problems then as the 110,000 volts of to-day.

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The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

What Sank the "Lusitania"?

IN its endeavor to becloud the issue, official Germany has claimed that the ammunition carried by the "Lusitania" contributed largely to the swift sinking of that great ship.

Now this is a technical question, and to anyone who is technically qualified to judge the matter, the explanation offered is, on the face of it, absurd.

This war has proved over and over again that one submarine torpedo of the German type, carrying 420 pounds of high explosive, is sufficient to sink a warship—even a battleship which, exclusive of the double bottom deck, is divided into no less than two hundred and fifty separate watertight compartments, big and small.

The question of the length of time a ship fully subdivided will remain afloat after being torpedoed, depends largely upon where the blow gets home. In the case of a battleship, especially a thoroughly modern ship like the "Audacious," the blow of a mine or a torpedo, in addition to the local damage, may so badly shake up and loosen her internal structure, that gradual seepage of water will occur through the bulkheads, and she will eventually sink several hours after the attack. But should the blow strike in the region of a magazine, as in the case of the Russian "Petropavlovsk" and the Japanese "Hatsuse," the explosion of the torpedo warhead may instantly be succeeded by the far greater explosion of the whole magazine, and the ship, no matter what her size, will go down in two or three minutes' time.

Now the fact that the "Lusitania" remained afloat eighteen or twenty minutes after being torpedoed completely disproves the assertion of the Germans that her cargo of ammunition exploded—and nobody knows this so perfectly well as Admiral von Tirpitz himself and the subordinate in command of the submarine which sank the ship.

To be convinced of this, let us consider the case of two warships in which the ammunition exploded, and see what happened. In the case of the U. S. S. "Maine," when the flame and shock of the mine which contributed to her swift sinking reached the forward magazines, they exploded and the enormous force of the gases lifted her forward deck and rolled it back upon the after part of the ship just as one would turn the leaf of a book. Again, take the case of the French battleship "Liberté," whose forward magazine exploded through deterioration of her smokeless powder. Exactly the same thing happened as in the case of the "Maine," but on a larger and more destructive scale. The decks of this great ship lying above her magazine were torn loose from the hull, lifted high in air and rolled back, upside down, upon the after part of the ship.

If the cargo of ammunition carried by the "Lusitania" had been set off by the torpedo which struck her, similar results would have followed. The enormous expansive force of the gases of the explosion would have blown out the sides of the ship above the waterline and torn open her decks above, folding them back upon themselves. Did any such destruction occur? Was there any evidence whatsoever of such an explosion? The very fact that the ship remained afloat as long as she did proves that nothing of the kind happened, and that the ammunition in her hold had no part in the sinking of the ship.

So enormous is the charge of explosive carried by the submarine torpedo of the Germans that the single torpedo which struck her not only tore a vast opening in the outer skin of the ship, but the disruptive effects of the gases let loose under high pressure within her hull structure were sufficient to wreck the inner wall of the side bunkers and produce an immediate and enormous inrush of water, besides loosening up the frames and bulkheading in the neighborhood of the explosion to such an extent that less than half an hour was sufficient to put the great ship below the surface.

A battleship not only carries a heavy watertight protective deck, but the underwater portion of the ship below this deck is divided and subdivided transversely and longitudinally until she contains, as we have said, over two hundred and fifty separate watertight compartments, big and little.

The "Lusitania" contained below the waterline only thirty-four such compartments—and this was all that could be conveniently accommodated within a ship whose primary purpose was for the uses of commerce and not to face the perils of modern submarine warfare. Since she was designed the explosive charge in the warheads of torpedoes, at least of those used on submarines, has been more than doubled. The commander of the German submarine, when he discharged his torpedo at point-blank range and saw it strike home, knew that the "Lusitania" would probably go down fast and long before her helpless passengers could take to the boats. This was expected and so intended by the Imperial German Admiralty.

The War and the Scholars

BUT for the fact that philosophers have so often, in the past, proved to be anything but philosophic when put to the test, we should view with much astonishment the efforts made by the savants of a certain belligerent country of Europe to disparage the intellectual achievements of their erstwhile friends and colleagues among the enemy.

German scholars had so long been in the habit of taking their own intellectual superiority for granted that there was little left for them to say on the subject when the war broke out. French scholarship was somewhat tinged with chauvinism before the war, and the French temperament serves to explain many things. The scholars of England, however, who had for some time been living under the spell of the supposed preeminence of things German, suddenly executed so complete a *volte-face* as to suggest, first, that the English are a more volatile race than we had supposed them to be, and, second, that if these same scholars are now sincere, they must have been amazingly deficient in good judgment prior to the first of last August.

We hasten to say that this criticism does not apply to all English scholars, though it does apply to some who are very highly placed in the learned world. The purpose of the present article is, indeed, to contrast the attitudes of two classes of Englishmen, viz., those who have completely lost their heads in their eagerness to dispraise the enemy, and those who have not permitted their patriotism to get the better of their good sense.

It may be admitted that German scholarship had become a somewhat extravagant cult in England before the war, and that a return to normal-mindedness in this respect was altogether desirable. Normal-mindedness is not, however, evinced in the following onslaught which Prof. Sayce of Oxford recently delivered in the *Times:*

"It is astonishing that British scholars and politicians should still be found speaking of 'our intellectual debt to Germany.' It is worth while, therefore, examining in the dry light of reason what Germany has really done for culture and scientific progress.

"As to music, I can say nothing, for I am not a musician. In literature Germany has Goethe, who occupies the first rank. Heine was a Jew, who regarded the Germans as barbarians. Schiller, the most characteristically German of German writers, was a milk-and-water Longfellow. In philosophy there are Kant and Hegel, but Kant was more than half Scottish in origin, and it is difficult to say what the Hegelian philosophy would have been had the German language been more cultivated. In science none of the great names is German. We look in vain for any that can be put by the side of those of Newton, Darwin, Faraday, Laplace, or Pasteur. In my own departments of study it is the same tale. . . . On the artistic side perhaps the less said the better. German taste in architecture and dress is proverbial."

Is it necessary to comment on this extraordinary diatribe? We regret that Prof. Sayce is not a musician, for his authoritative opinion of German music would undoubtedly have been interesting. As to the rest, let us frankly admit that German culture has been overrated in some quarters. Does it not remain true that the whole world owes an "intellectual debt to Germany," and a heavy one?

It is pleasant to turn to a more temperate estimate of German achievements, from the pen of a British man of science who has always been imbued with the spirit of world-wide solidarity in intellectual matters. Dr. Hugh Robert Mill, director of the British Rainfall Organization, writes in *Symons's Meteorological Magazine:*

"At this time, when it is as fashionable to ridicule and decry all things German as it was to ridicule and decry all things pertaining to other nations a century or sixty years ago, we feel it to be a matter of scientific duty to acknowledge our equal indebtedness in the past fifty years to all these nations. Whatever may be the opinion of some men of science as to the inferiority of Germans in their particular studies, we and our readers cannot fail to remember how much we owe to German and Austrian meteorologists. While we yield to no one in our detestation of the war which Germany and Austria-Hungary have forced upon the world, or in our determination to do all that is possible to defeat the aggressions and ambitions of those governments, we cannot be so false to our own consistency as to stigmatize as poor or contemptible those vast and noble acquisitions to knowledge made in the last half century by those Germans, whom, up to last summer, all our learned societies delighted to honor. Although for the present we carry on our work without the aid of the subjects of enemy-empires, we trust that our pages in years to come will once again rejoice in the brotherhood of the men of science of a re-made Europe and a world at peace."

"Inventions Wanted"

"INVENTIONS wanted." You see it often at the head of articles in newspapers, calling the attention of inventors to needed improvements. It also appears in the literature sent out by patent fakers and by some agents who are not fakers. Probably every inventor has scanned such lists in the hope that he might find there some idea of real value. Ideas there are in plenty, but they resemble the bunches of "outlaw" horses which some unscrupulous dealers a few years ago were wont to gather on the prairies and ship east to be sold to unsuspecting farmers. These collections of "long-felt wants" represent what is left over after all the tractable, easy-to-handle ideas have been caught, harnessed, and put to work.

In the majority of cases as much invention is displayed in discovering the need of a new device or machine as in perfecting the mechanism by which the need is supplied.

Take, for example, half a dozen American inventions in common use—the telegraph, telephone, typewriter, phonograph, sewing machine, and harvester. From the point of view of the inventor of mechanisms, the sewing machine and the self binder are perhaps as ingenious as any of them. What is remarkable about them as a group is not mechanical ingenuity; it is the prophetic foresight of the inventors who saw, imperfectly, no doubt, but clearly enough to be inspired thereby, a vision of a world transformed. They saw the housewife relieved of endless drudgery; the farmer's capacity for production multiplied; the slaves of the pen set free.

But the chief difficulties they surmounted were not mechanical. They arose from the lack of proper means of perfecting their inventions and from the apathy and indifference of those whom the inventions were intended to benefit. Many a student has set before him more intricate problems than were there in their primary form. But a student knows his task is possible; the inventor believes his is also, but often he cannot get anyone else to think so. The ingenuity displayed in perfecting these devices is less wonderful than the fact that the world was so long content to plod along without them.

People did not know that they wanted these things. Some, who had little else to do, vaguely dreamt of them, perhaps, but the world at large was quite satisfied. Mankind wants everything in sight, but what is not in sight it assumes to be impossible of attainment.

But the inventor knew that his devices were needed and in his mind's eye he saw the operation of the particular law or coincidence of several laws by which his dream was to be realized. Therein lay his genius. Were there no such thing as a telephone in existence we could pick a hundred men perfectly competent to invent and perfect it, could we convince them of its possibility and importance. But most of us cannot pick the next man who is to pierce the future and banish some burden we now labor under because we can see no hope of relief and have no faith in such relief.

As a general rule, inventors will find that the problems set for them in "Inventions Wanted" are not usually the most promising avenues to success. Having resisted the efforts of other minds, such problems are often destined to remain unsolved until the discovery of a wholly new principle or some often apparently unrelated fact opens the way to a solution.

The inventor's best chance lies in filling unfelt needs, not in wrestling with "long-felt wants."

Science

Wrapped and Unwrapped Bread.—A considerable amount of recent literature has been devoted to the subject of wrapping bread. An elaborate chemical and bacteriological investigation of the subject was reported some time ago by Jacobs, Leclerc and Mason in the *American Journal of Public Health*. These investigators sought to determine the kind of paper most suitable for wrapping, the length of time after baking that bread should be wrapped, and the bacteriological condition and weight of both wrapped and unwrapped bread. For breads whose crusts are to be kept dry and firm, such as Vienna and French breads, porous paper is better than waxed paper. Bread reaches the temperature of the room about three hours after baking, and this is the best time to wrap it. Further delay entails the danger of contamination with bacteria and molds. If wrapped too soon—say, one hour after baking—it retains sufficient heat and moisture to favor the growth of organisms, especially when waxed paper is used. The crust of the loaf as it leaves the oven is practically sterile. The same writers examined a large number of samples of both wrapped and unwrapped bread bought in retail stores. Of the unwrapped loaves 62 per cent showed organisms of the *B. coli* type, as compared with only 7 per cent of the wrapped loaves. Another contribution to this subject is an article by Barnard and Bishop in the *American Food Journal*, dealing with the effect of wrapping upon the chemical composition of the loaf. It was found that wrapping in either semi-porous waxed or paraffin paper prevents the escape of moisture and tends to preserve the colloidal condition and physico-chemical equilibrium, the destruction of which produces staleness. The effects of wrapping vary considerably for different kinds of bread.

A Guide to Our Edible Fungi.—As everybody knows, a deplorable amount of good food goes tc waste because the public is familiar with but few of the many edible species of fungi. It is true that the nutritive value of fungi has been much exaggerated; they are by no means comparable in dietary value to meat, as is often claimed; but on the other hand, they are more nutritious and, when properly cooked, decidedly more palatable than many things that enter into the everyday menu. A desultory propaganda in behalf of mycophagy has been carried on for years, both in this country and abroad. The latest contribution to this campaign is Bulletin No. 175, just issued by the Department of Agriculture, entitled "Mushrooms and Other Common Fungi." In this useful manual, the authors, Flora W. Patterson and Vera K. Charles, tell us, among other things, of the efforts which certain European governments have made to teach their citizens the food value of mushrooms. All over France exhibits of the more desirable species are held; while at Ro.len during the season there are daily lectures on this subject illustrated by fresh specimens. In Saxony systematic instruction concerning mushrooms is given in the public schools. The French have taken to canning many wild mushrooms, in addition to the familiar *Agaricus campestris* grown in mushroom cellars, and these are now exported to the United States, which also receives tons of dried wild mushrooms from China. The new bulletin contains descriptions, in language as non-technical as the circumstances admit, of more than 150 species of fungi, together with splendid photographs of at least half of the species described. The poisonous species are carefully pointed out, and several recipes for cooking the other kinds are appended. There is a simple key to the genera and a glossary.

The Chemistry of the Pacific Kelps.—We have recently noted the appearance of a bulletin of the Department of Agriculture giving full statistics as to the extent of the giant kelp beds on the Pacific coast, and suggestions regarding their exploitation. A further important contribution to this subject is an article by Guy R. Stewart, of the California Agricultural Experiment Station, on the "Availability of the Nitrogen in Pacific Coast Kelps," published in the *Journal of Agricultural Research*. As a result of extensive experiments the author finds that in using dried and ground kelp as a fertilizer the readiness with which the nitrogen in it is changed to ammonia and nitrates in fresh field soil varies with different species and with the mode of preparation. The nitrogen of *Nereocystis luetkeana* is relatively very available, but this species is of minor commercial importance. The principal commercial species, *Macrocystis pyrifera*, is very slowly changed in the soil, the availability of its nitrogen being greatest when the kelp is added in a fresh or only partly dried condition. *Macrocystis* must, however, be dried till crisp in order to grind readily. This drying should not be continued longer than necessary, and the kelp should not be scorched or overheated. In the same *Journal* another California chemist, D. R. Hoagland, gives a detailed account of the "Organic Constituents of Pacific Coast Kelps." In connection therewith he deals with certain interesting economic phases of the kelp question; viz., the possible feeding value of kelps for man or animals, the utilization of its organic by-products, and the destructive distillation of kelp for commercial purposes. In all three directions the possibilities appear to be very slight.

Astronomy

The Spectrum of Mellish's Comet was observed at Lowell Observatory with the slit spectrograph on April 20th, and according to a telegram from Director Lowell, published in *Popular Astronomy*, was found to consist of the usual series of cometary bright bands, but with a relatively intense background of continuous, i. e., solar, spectrum of the emission bands. The group of bands about wave-length 4040 was brighter and those of hydrocarbons fainter than in most comets. A photograph of the comet on the same morning showed a tail of two divergent branches, 1½ and ¾ degrees long, respectively.

The Time Service at Antwerp, or Bureau de l'Heure, located at the Pilotage, continued its work up to the date of the German bombardment, last October. This office normally gets its time by telephone from the Royal Observatory at Uccle, but after the latter institution was seized by the Germans on August 20th communication with it was cut off. Thereafter the service was maintained without astronomical observations, as the Riefler clock at the Antwerp office was known to have a very regular rate, and it was checked with the aid of a number of good chronometers. The small observatory of the Antwerp Astronomical Society is reported to have suffered no harm in the bombardment.

The Astronomical Society of Pomona College, at Claremont, California, consists of students of astronomy and members of the faculty of the college, together with resident college graduates engaged in astronomical work or study; there are also associate members, including alumni and others. Considering the local character of the society, its quarterly journal, known as the *Publication* of the Astronomical Society of Pomona College, now in its fourth volume, is a remarkable production. It is printed on the best paper, fully illustrated with photographs, charts, etc., and, last but not least, is replete with interesting astronomical literature. Besides original articles, each number contains signed abstracts of the most important current astronomical articles in other journals. The editor of the *Publica ion*, president of the society, and director of the college observatory is Prof. Frank P. Brackett.

An Association of Amateur Telescope Builders.—There has recently been organized in the Society for Practical Astronomy a Section for Construction of Astronomical Instruments, and efforts are being made to enroll therein as large a number as possible of amateur constructors of telescpoes and other astronomical apparatus in all parts of the world. Builders of home-made telescopes are very numerous. The new association offers them an opportunity of aiding one another with suggestions, besides which something in the nature of a correspondence course in telescope building is to be given by the director of the section, Prof. M. T. Fullan, of the Alabama Polytechnic Institute, Auburn, Ala. Persons who wish to become members should write to Prof. Fullan. Although the section is interested primarily in the making of telescopes, especially reflectors, it will also devote attention to such accessories as photographic cameras, spectroscopes, eyepieces, sidereal clocks, and other kindred apparatus.

Suggestions for Observing Mars.—Prof. W. H. Pickering's latest Report on Mars (No. 9) consists entirely of suggestions for the guidance of amateur and professional observers of the planet at its next opposition. No one who intends to make drawings of Mars can afford to igno.e th's report (given in full in *Popular Astronomy* for May). For studies of color a large aperture is desirable, but the definition of the surface markings is satisfactory, under good atmospheric conditions, with an aperture of 5 inches, while many canals were clearly seen by Prof. Pickering at the last opposition in his 3-inch finder with a magnification of 180. For comparison of the "seeing" at different stations or on different nights a standard scale is recommended, defined by the appearance of the image or disc of a bright star and the diffraction rings. Perfect seeing is designated 10 in a 5-inch refractor, 11 in a 7-inch, 12 in a 10-inch, and 13 in a 14-inch. It is of little use to observe Mars when the seeing is below 6 or the altitude is below 30 degrees. The writer uses water colors for the groundwork of the disk, the yellow ochre, orange and reds, but for the greens, blues and browns he finds colored pencils, in connection with lead pencils of various degrees of hardness, more satisfactory. In order to apply the correct tints it is very important that the source of light illuminating the paper should be of the same color as the sun seen from a distant body. Prof. Pickering used small tungsten lamps at the last opposition, and at the next proposes to have the light of the same lamps transmitted through pale blue glass, thus giving the paper an illumination of very nearly the same color as the illumination of the surface of Mars by the sun. It is especially desired to secure as many drawings as possible of the planet in certain standard aspects; viz., when the Martian longitudes 0, 60, 120, 180, 240, and 300 are central at the point of observation. This plan was followed by a few observers at the last opposition, and comparisons of the drawings have given very interesting results.

Notes for Inventors

Woman Patentee Abroad.—It is believed that Sybilla Masters was the first American woman to secure a foreign patent, she having, through Thomas Masters, secured a British patent No. 401, dated November 25th, 1715, for a Process for Treating Corn.

Lighting the Key-hole.—August Sundh of Hastings-Upon-Hudson, New York, has patented, No. 1,136,378, an illuminated door knob having an electric lamp which may be lighted by a suitable button to give light to a key-hole or to the dial of a safe.

Deck Seats Convertible to Life Boat.—David Davies of North Carlton, Victoria, Australia, has obtained patent No. 1,134,672 in which are shown two longitudinal half sections adapted to be used separately as deck seats on a ship and to be united and secured together to form a life boat.

A Golfer's Exerciser.—A patent, No. 1,137,349, has been issued to Frances E. Patterson of Wilmington, Del., for an apparatus in which a golf grip or handle is connected at one end to a flexible cord which is wound on a spring spool and operates with tension on the grip in the successive movements representing the swing of a golf club.

Apparatus for Cooling and Agitating the Air.—Herman E. Baumgartner of Osage, Iowa, has patented, No. 1,133,255, an apparatus in which a pan supports a block of ice alongside of which is formed a housing for an electric fan, the infeed of which opens toward the block of ice so that the air is sucked over the block of ice and the cool air is forced into circulation.

Influencing Unemerged Teeth.—Patent No. 1,137,298 to W. E. Walker of New Orleans, La., is for a device for influencing the alveolar process seeking to develop artificially a pressure simulating lip pressure and thereby exert an influence through the gums upon unemerged but wrongfully disposed teeth, or counteract the influence of the tongue in a patient predisposed to press the same against the gums as frequently occurs in mouth breathing.

Adjustable Golf Stick.—D. & K. Roberts of Grantham, England, in patent No. 1,135,621 present a golf club the head of which is formed to permit the convenient interchangeability of heads or striking faces, each of the head pieces having two faces either of which may be adjusted into playing position and the several different forms of head being interchangeably applied to the head of the club so that each loose head is the equivalent of two ordinary clubs and by carrying a number of loose heads the necessity of carrying numerous clubs will be avoided.

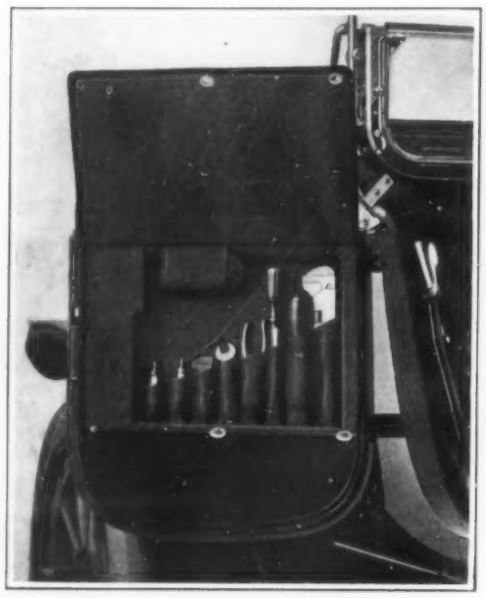
Oscillation-receiving Devices for Wireless.—Four patents, Nos. 1,136,044 to 1,136,047, inclusive, have been issued to the Wireless Specialty Company of Boston as assignee of Greenleaf Whittier Pickard of Amesbury, Mass. In the first patent the receiving device has a member containing silicon with a contacting member containing metal antimony; in the second patent the contacting member contains arsenic and antimony; in the third patent the contacting member contains metal bismuth and in the fourth patent the contacting member contains metal arsenic.

A Golf Patent for Keeping the Eye on the Ball.—C. T. Ramsay of Liverpool, England, patent No. 1,135,921, shows an optical instrument which can be worn over the eyes like a spectacle and by which the sight of the player is concentrated on the ball, the opaque "blinkers" having a relatively small aperture through which, and through which alone, the wearer can see and thus the distance in front and behind the ball is so small that he must see it definitely and he is thus compelled to keep his eye on the ball. The blinkers are adjustable so they can be set to suit the eyes of different persons.

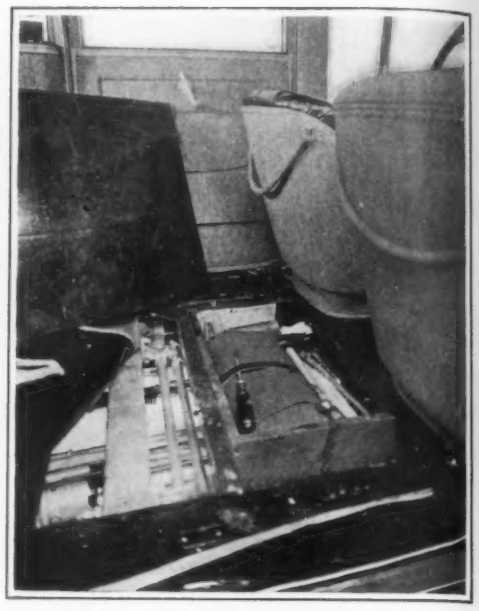
Novel Hat Brush.—A hat brush which is carried within the hat itself is a recent Paris novelty. It can be used with felt or silk hats. The brush is of small size and very light weight, and is provided with a clamp which allows of fixing it inside the hat, and in this position it is out of the way and does not add materially to the weight of the hat. Such a little device will prove most convenient either for ordinary times or in traveling. Two kinds of brush can be used according to the case, that is, a fine brush for felt hats or a plush makeup for use with silk hats. The brush in any case does not weigh more than half an ounce.

War's Effects on Foreign Patents.—It is sometimes asked by Americans whether patents can be obtained at the present time from the nations at war and it is somewhat remarkable how little difficulty is experienced in transacting business with the foreign Patent Office. Nevertheless, the number of applications filed abroad has been greatly reduced as illustrated, for instance, in the United Kingdom, reports giving the number of applications received in the British Patent Office in 1914 as smaller than in any other year of the last decade, the number of applications for 1914 being 24,820, while in 1913 it was 30,077. Design applications in 1914 were 34,354 and in 1913 were 40,429 and trade-mark applications in 1913 were 9,689 as against 8,317 in 1914.

Stowage compartments in closed cars generally are a problem; in this car, the basket slides down into a compartment behind one of the seats.



Most bodies are mere shells. This is an example of how a thinking designer has made use of what otherwise would be waste space.

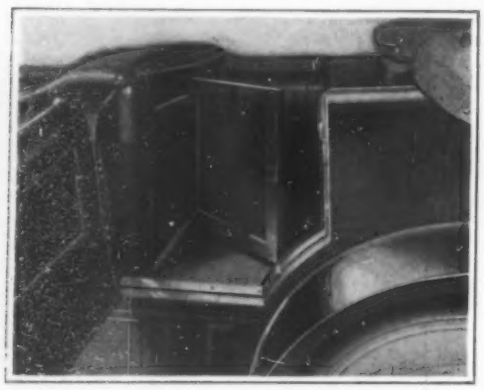


Here is an example of how a manufacturer has made use of space that otherwise would be wasted; a tool locker under the floor.

Storing the Tourists' Needs

By Stanley Petman

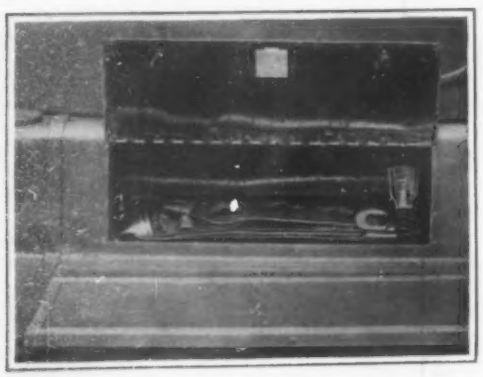
WHEN the first automobile tourist filled his tanks, cranked up and started on a journey fraught with more or less excitement, he experienced no particular problem in disposing of the equipment, the edibles and what-nots that then and now are a penance and a pleasure. In the first place, he had not a great deal in the way of equipment, and in the second place, the appearance of his car on the road could create no more comment if loaded down with boxes, baskets, and carry-alls than if it had none of these homely conveniences. The early tourists made no bones about appearance.



Large compartments at the back of the front seats serve to house the auxiliary chairs when they are not in use.

One box, more or less, strapped to a running-board or to the back of the tonneau, made no difference to the peace of mind of the owner.

But automobiles and the persons they carry have changed somewhat since those early days. The modern creation, to find favor in the eyes of a purchaser, must be long and lean and sleek and smooth. In short, it must be a finished creation in the fullest sense of the word; make-shifts have no place in its makeup. There must be a place for everything, which it is the duty of



When tools are placed in this locker they are instantly available without the need for disturbing the passengers.

How waste space is utilized in a closed car. The compartment is large enough to house several bags in addition to spare tires, tools, etc.

the manufacturer to produce, and everything must be in its place, which is the duty of the owner.

It is a fact worthy of note and comment that though the modern car is carrying a great deal more equipment than did any of its illustrious predecessors and there is a great deal more room for the disposal of the things the tourist considers necessary, there is less in the appearance of the cars now to indicate this than ever

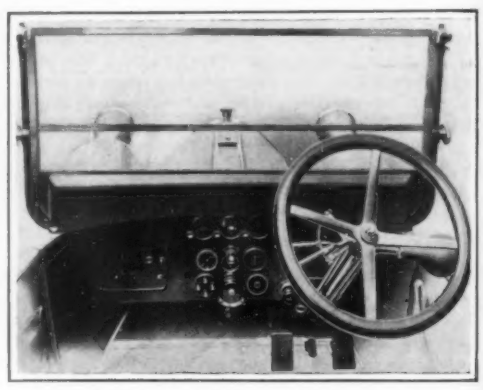
Route books, maps, touring data and other things that are wanted quickly fit nicely into these deep pockets.

before; and what is of greater importance, it seems likely that though the cars that are to come next year and the year after will provide carrying space for still more of what may be termed luxuries, there will be still less indication of their increase in capacity.

Now, the most natural question in the world is, Why? Why can the modern car be made such a carry-all without in the least destroying its lines? Why are there no bulbous protuberances? Where have the designers put all the things that once were in more or less plain view?

The answer to the first question is to be found solely in the skill of the designers. In a way they may be accused of taking a leaf or two from the books of their French cousins, for assuredly the French—and other European designers, be it added—are past masters in the art of providing almost extraordinary carrying capacity for freight other than passengers, and concealing it in the most ingenious manner.

Though the modern motorcar has proceeded along scientific lines and its development has come slowly in the light of past experience, it would seem that there is at least one feature of design that has not been given



Small cupboards in the deep cowl serve as convenient receptacles for goggles, gloves and the like.

all the attention that it warrants; and, in the same breath, it would seem that this feature now is being given more attention than ever before.

That feature is the careful utilization of waste space. To the average owner who knows not a great deal about the actual construction of his car, it may appear that there is not a great deal of room that has not been put to some useful purpose. But in the majority of cases this is not so. There are a dozen places where

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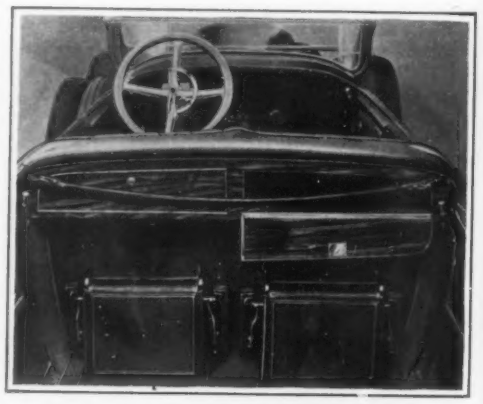
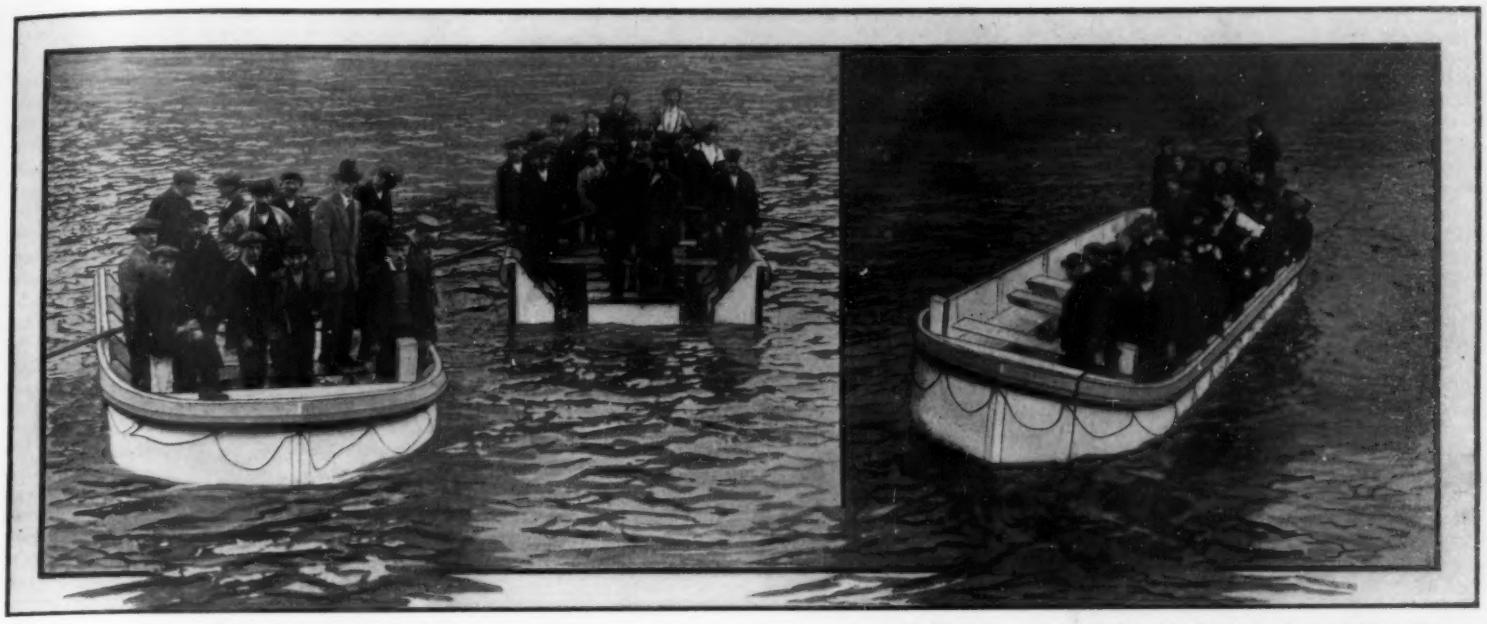


Here are some clever compartments that occupy the space between the foundation of the body and the outer shell.



Life-boat divided into two parts to demonstrate buoyancy.

Thirty-four men on one side of the boat to show stability.

A New Life-boat

THE periodic recurrence of startling disasters at sea keeps the subject of efficient life-boats prominently before the public, and the apparent failure of the life-saving devices in many such cases, whether through deficiency in the apparatus, or in the utilizing and handling the same, frequently raises this most important question.

Efforts by inventors are, however, not lacking, and only a short time ago a new craft was tested out in England with apparent satisfaction. In principle it does not seem, from the information at hand, that there is very much that is new in it; but in the carrying out of the design unusually excellent results have been secured in buoyancy, stability and strength, for it can be raised or lowered with great weights without injury or distortion, and apparently can be safely launched overboard from a considerable height, as from the upper deck of a ship, in case of necessity and when davits were not available. In cases of this kind roller chocks, upon which the boat is adapted to rest, would make the operation possible. These same chocks can be arranged so that a boat can be easily moved forward or aft to a convenient position for lowering.

The foundation, so to speak, of this boat appears to be three lines of air tanks running longitudinally in its bottom, leaving two bilges between in which water coming aboard can collect without incommoding the passengers in ordinary cases. These tanks furnish sufficient buoyancy in a boat 28 feet long by 9 feet beam to support two hundred people, although such a number could not be practically accommodated in actual use. One of the illustrations shows thirty-four men grouped on one side of the boat, demonstrating its stability, while in another illustration the two portions of a boat that has been cut in two and loaded with passengers shows its buoyancy. Of course, the lines of air tanks are subdivided into many sections, some forty in number, so that if some are damaged so that they leak there is still ample floating power left. This quality makes these boats especially valuable in war service, for they can be punctured many times by bullets without becoming unseaworthy.

These boats are partially self-emptying, as pipes are provided that will carry off all water above the tops of the air tanks. This new style of life-boat, known as the Gerard, has been satisfactorily tested in England, and is soon to be put through a thorough series of trials in this country.

The Study of Animal and Human Behavior

By Dr. L. K. Hirshberg

THE study of psychology has branched out into two new sciences of animal behavior and human behavior. Prof. John T. Watson is the leading exponent of the department of animal behavior, while Prof. R. M. Yerkes now tells the scientific world what human behavior is. This new science, he says, is only a portion of the general science of organic behavior. It presents practically the same problems as does animal behavior. To learn about the human "mind" you must perform the same sort of experiments as are conducted upon animals.

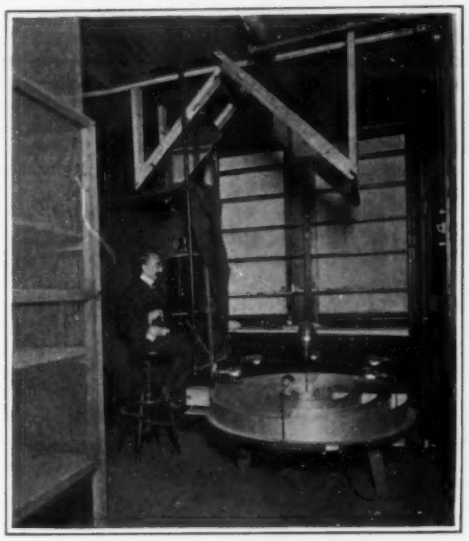
The behavior of mankind indicates the mind of the humans. There are really no ways in which you can discover a man's or an animal's mind except by what it does, what its habits are, or what it produces.

Not only the books, the periodicals, and the teachers of popular psychology, but a whole host of men who should know better, still teach that there are such things and activities as impulsive, habitual, instinctive, voluntary and reflex behavior. Says Dr. Yerkes: "This time-honored classification is no longer in favor."

Instincts are things to be observed and re-observed under varied and rigidly controlled conditions. What is true of instincts is also true of various senses and of habits.

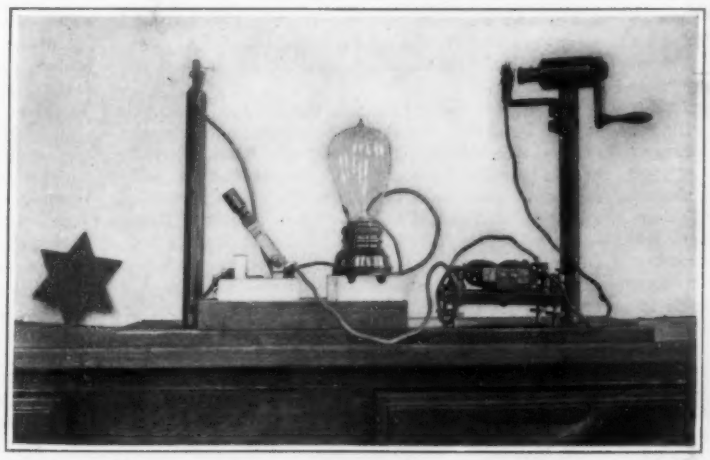
It is rather late to define behavior, yet an attempt to do so may serve to correct certain impressions which seem not uncommon. The term, as used by the scientist to-day, is inclusive not merely of those gross and obvious activities exhibited by man in common with the other animals but of hidden organic processes. The behaviorist is interested quite as much in reflexes which might ordinarily be relegated to physiology, as in habitual or instinctive or voluntary acts. But he is interested, also, as much in the complex forms of behavior, known as conduct, as in the simpler expressions of human intelligence.

But the practical-minded person has doubtless been asking, "How may the reactions of a person be scientifically studied? Is it possible, ordinarily, to subject a human being to such conditions of observation as are used in experiments with other animals?" A few examples from studies of human and infra-human behavior will serve as an answer to these questions.



Dr. Watson's maze for white rats.

The ability of the animals to make their way out is an index of their mental capacity and behavior.



The shocking apparatus used to correct mistakes of animals in learning problems.

The shock is at its maximum never enough to cause pain.

One of the most interesting aspects of organic activity is its modifiability. It is designated as habit-formation. Now, it happens that in a great variety of organisms the formation of habits has been studied experimentally. In the case of the dancing mouse, for example, the relation of rapidity of habit-formation to certain external conditions was investigated. An apparatus was so arranged that the mouse could choose as its route either a dark or light passageway; then was determined the number of experiences necessary in order that the animal should learn that, no matter what the spacial relations of the passageways, only the light one could be safely chosen as a way of egress, since each time the dark passageway was entered a disagreeable electric shock resulted. In this experiment, which was so conducted that strictly comparable results were obtained from several individuals, it was first ascertained that the less the difference in lightness of the two passageways, the longer it took the mouse to learn to choose correctly. Next, it was determined that the rapidity of learning varied with the strength of the electric shock, which was regularly given as punishment for mistakes. When the passageway differed markedly, the stronger the shock the more rapid the learning. When the passageways differed slightly, beyond a certain point, increase in the strength of the shock delayed the learning process. When the passageways differed by an intermediate amount, it appeared that an intermediate strength of stimulus was most favorable to habit-formation. From these observations it was possible to deduce the following law for the behavior of the dancing mouse. As the difficultness of visual discrimination increases, that strength of electric stimulus which is most favorable as a condition for the acquisition of a habit tends to approach a bare perceptibility.

In this investigation there is, first, a definite problem; second, a reasonably large number of observational data; and third, a law of behavior, for the particular organism in question. In effect, what was done with the dancing mouse might be done with human subjects, should it seem desirable to gain definite knowledge of aspect of habit-formation.

Another illustration may be taken from the study of imitative activity. It is generally recognized that imitation may be studied experimentally in any organism. But up to the present most observations of this group of phenomena have been

casual, and opinions concerning the importance of imitation in any organism are quite likely to be based upon insufficient or inaccurate information.

In order to exhibit in the general features a method of studying imitation experimentally, investigations of this aspect of behavior in monkeys shall be considered. First of all, a number of acts or series of acts are sought which the animals either cannot learn to perform of their own initiative or learn with extreme difficulty. Such acts are most readily discovered in connection with artificially arranged situations as, for example, in connection with puzzle or problem boxes and similar experimental devices. The experimenter teaches one animal to perform an act, and thereafter, under definitely describable and constant conditions, he permits another animal to observe the behavior of the first. Any tendency for the second animal to imitate the first, or to modify its behavior in accordance with the activities of the first, is noted.

Such experimental studies as those of Watson and Hagerty have proved that certain monkeys imitate much less generally than is commonly supposed. And further, that they imitate seldom, if ever, in the purposive manner in which man imitates. It seems that, although they influence one another markedly in their behavior, this influence is chiefly a matter of the directing of attentions. The imitations of means in a voluntary and wholly conscious manner rarely appears among the mammals below man.

An illustration from actual experimental work which clearly indicates the need of analyzing behavior complexes and of dealing quantitatively with simple bits of behavior is furnished by some recent work which was done with rats. The object was to try to discover the modes of heredity of savageness and wildness in rats. In order to accomplish this task, it was necessary to analyze this savageness and wildness. This meant discovering those acts or organic processes which, taken together, mean to the observer savageness or wildness. The first result of observation was that biting, squealing, struggling to escape or attacking the experimenter and process of excretion appeared as important elements of savageness. The experimenter, relying upon these elements, measured roughly the savageness of a large number of individuals, arranging them according to their behavior in six grades, designated naught to five. On the basis of this obviously crude preliminary work certain facts indicative of the mode of transmission of savageness and wildness were ascertained.

In yet other observations on rats which involved the comparison of two group stock individuals and closely inbred individuals it appeared that the behavior of the two groups, in the face of certain experimentally arranged situations, differed greatly. This, upon careful observation, was attributed to differences of temperament. The stock rats were rather active, energetic, quick moving, whereas the inbred animals were more stolid, slow and deliberate. In order that the reactions of these individuals in various experimental situations be properly interpreted, it is essential that the experimenter obtain knowledge of their temperamental character, such, for example, as degrees of nervousness or of timidity, of savageness or wildness, quickness of response, persistence, energy, and so on through the list of aspects of behavior which, looked at as a whole, might be considered the temperament of the animal.

It is always safer to deal with items of behavior in a large or wholesale manner—safer, for example, to study capacity for a particular sort of musical expression, singing or violin playing, than to study musical ability in general.

Methods might be described of studying distance orientation, usual discrimination, other aspects of habit-formation, the permanency of habits, instinct and emotion in animals, but it will suffice for the present purposes to describe briefly two methods of analyzing behavior which have recently been devised. These methods, unlike those in general use by students of animal behavior, are applicable to man and to other mammals, even to birds as well. They were, indeed, planned with the idea that they should make possible the comparison of reaction-types or reactive tendencies in birds and mammals, and all these in turn with the tendencies displayed by human beings, either mature or immature, either normal or abnormal.

The two methods are the quadruple choice method and the multiple choice method. In the former the subject of the experiment is placed in a small room, on one side of which there are four doors. From experience, he learns that he may escape by one of the four doors, and only one, but which of the four to choose is his problem, for it is the plan of the experimenter to lock on a given trial the door through which the animal escaped in the previous trial and two others. This animal has absolutely no way of predicting which is unlocked. The general question is, then, how will a given type of organism or a given individual meet this situation? What habitual manner of meeting it will be acquired? How will the modes of reaction displayed by a child compare with those of a man?

The other method is similar in purpose to that of the first, but it offers somewhat more satisfactory opportunity to evaluate and compare results. It consists, essentially, in the presentation to the subject-bird or mammal, young or old, normal or abnormal, of a bunch of twelve keys numbered from left to right, one to twelve. The subject is given to understand, veritably or through actual experience with the apparatus, that pressing some one of the twelve keys will yield a certain desired result, such, for example, as the displaying of a picture, the presentation of food, the ringing of a bell. The experimenter sees to it that in no two successive tricks is the same key the one to be operated. He is, further, able to push back out of sight any number of keys, and thus present to the subject as few as one or as many as twelve.

Assuming that in a given experiment the observer decides that the key the fourth from the left shall always be the "right" one, it then becomes the task of the subject of the experiment to suit his reactions to the number chosen by the experimenter. Only if he discovers the guiding idea of the experimenter can he succeed, trial after trial, in touching the right key at first. This method may be varied almost indefinitely in difficultness, and it may be made to elicit numerous reactive tendencies.

It is obvious that both of the methods thus briefly described are attempts to elicit general reactive tendencies rather than to analyze reactions minutely and carefully. The methods are indeed intended to bring into clear light those modes of responding to a given situation which are characteristic of different types or conditions of living beings, and thus to furnish a basis for a profitable comparison of reactive tendencies.

The question is frequently asked: "Why is it that the behaviorist deals so often with the activities of the lower animals and so seldom with those of man?" There are two reasons: in the first place, most lower animals are easily obtained, kept in confinement, bred and reared for experimental purposes; in the second place, many of them, in comparison with human beings, can be readily controlled throughout their lives and subjected to experimental conditions. Because, then, of the availability and controllability of lower animals, it is far easier and more satisfactory to make the preliminary exploration and problems defining observations on their behavior rather than on that of a man. It is further to be considered that the time of the human subject is worth infinitely more than that of an infra-human subject. On the whole, it seems clear that investigators work to advantage in the early stages of science of behavior by letting the lower animals help to the formulation of the problems and the development of the methods. Once fairly oriented and reasonably skilled in technique, they may with better effect attack the problems in human behavior.

What the National Guard Needs

By Lieut. W. W. Wright, Company E, Second Infantry, N.G.C.

THE Army League of the United States, an association composed of many of the nation's leading men, is putting forth an earnest effort for an adequate and efficient military force. The Army League favors an adequate Regular Army, Organized Militia and Reserves as the best guarantee of peace.

President Wilson in his last message to Congress expressed his sentiments as being in favor of an adequate Regular Army backed up by an efficient National Guard and Reserve, rather than a large standing army. The efforts of the Army League are apparently along these lines.

The President's view is a logical one. He believes that the backbone of the nation's military forces should be composed of militiamen, trained men in every-day walks of life, who might be called on in case of need as were the "minute men" of the revolutionary period. The most reasonable and economical way to maintain an efficient military force for defense without the establishment of a large standing army, then, is through the National Guard.

Why do not young men join the National Guard in sufficient numbers to make it the efficient and powerful reserve that the nation desires, and what action is needed to make it appeal to the patriotism of our young men and induce them to enlist?

It cannot be denied that there is a shortage of suitable recruits for the National Guard and that the War Department finds considerable fault because many organizations of the various States are unable to recruit up to the minimum number required by the Government.

There are many reasons for this state of affairs.

In the first place, the National Guard is no longer to be looked upon as a social organization as it was in years past, when the chief duties required of it were to turn out in gaudy uniforms for dress parade or at social functions.

Since the passage of the Dick law several years ago the militia has been armed and equipped in exactly the same manner as the Regular Army, and it is now a plain business proposition, organized and destined to be conducted on a business basis as a part of the nation's first line of defense.

The same is expected of it as of the Regular Army, whose regulations it must adhere to, *only not so much of it.* While on duty its members must drill, work, and study the same as the regulars, *only not so much of it.*

Therefore, *why should not its members receive a certain per cent of Regular Army pay?*

From personal observations, made during more than ten years' service in the National Guard of three States, I believe that the sooner the "Pay Bill," which has been pending before Congress for the past three years or more, is passed, the sooner will the National Guard become the powerful and efficient backbone of our defense which the nation needs and desires it to be.

It has been said that you cannot buy patriotism. This is very true, *but how many men would join the Regular Army if they were not to receive some compensation for their services?*

The one great fault with the National Guard, the seat of all the trouble and the cause of the greatest anxiety to nearly all company officers, is the lack of suitable recruits with which to fill up their companies.

Give the average company commander in the National Guard enough good men, and provide a source of available recruits to draw from to fill up vacancies which constantly occur, and I dare say that he will turn out a company to be proud of and one which will compare favorably with a company of the Regular Army.

How many captains of the Regular Army would remain in the service if they were required to go out and rope and hog-tie men and pull them into the service? Yet this is practically what company officers in the National Guard are required to do to maintain their commands.

Each year recruits are becoming scarcer and scarcer, and the work demanded of both officers and men becomes more exacting. Each year the Government supplies us with more modern equipment, but what can we do with new guns and modern equipment, if we have not the men to use them? We are now furnished with practically everything required, except the most important of all, the recruits.

We now have sanitary corps and headquarter companies. Why not a recruiting service?

Company commanders in the Regular Army have drilled recruits assigned to them. Company commanders in the militia have to go out and hunt for theirs, and in many cases it becomes necessary to place raw recruits in the ranks in order to fill out their skeleton companies. When it is considered that one or two undrilled men can spoil the appearance of an entire company, is it any wonder that National Guard companies do not always appear to the best advantage? It does not signify that the average militiaman is not well drilled.

What would the Army or Navy of the United States amount to if the Government did not have an efficient recruiting service to supply its enlisted personnel? The United States spends vast sums of money annually to secure recruits for each branch of the service. The recruiting branch of the service is as necessary a part of the Army and Navy as are their fighting units.

Therefore I advocate the establishment of a recruiting service for the National Guard. Not to secure recruits in exactly the same manner as the Army and Navy do, but along somewhat similar lines.

I would suggest that the Regular Army bands be brought into play, and that they be detailed by the War Department in conjunction with able patriotic speakers and recruiting officers, to go to towns where a stimulus is needed to induce young men to enlist.

Patriotic concerts by army bands, which, as a rule, are not overburdened by their duties at the army posts, and speeches by able orators should tend to awaken the dormant patriotism in many young Americans and cause them to join the National Guard.

Suitable literature, both in circulars and billboard posters, setting forth the advantages and benefits to be derived from membership in the militia, should also be an aid in securing recruits.

One of the principal aims of the Army League is to combat the systematic anti-military propaganda of various organizations and of certain sections of the press, as occasionally shown in apparent efforts to prevent enlistment, and to encourage desertion and dissension in the existing *personnel.*

The general public, perhaps, is not aware that such anarchism and un-Americanism exists in this country, but it is true, nevertheless, that the propaganda of these various individuals and organizations has had the harmful effect of placing the National Guard in an unfavorable light in the eyes of some people, and it has unquestionably prevented many good men from enlisting therein.

The action of the Army League in this respect is a commendable one and should receive the support of all good Americans.

Sooner or later the Government may be obliged to

take drastic action in regard to this matter. It has taken years of unwarranted agitation and abuse to injure the National Guard in this manner. It will take considerable counter action to again place it in the esteem of all the people, where it rightly belongs.

Another point I wish to bring out is the promiscuous use of the uniform or parts of the uniform by persons unauthorized to wear such. One of the first things that officers are required to teach their men is to take pride in their uniforms.

What effect, then, does it have on the men of the Regular Army or the militia, when they see expressmen, cab drivers, members of lodge organizations, drum corps, etc., wearing the same uniform as they, or so near alike as to be undistinguishable to the eye of the ordinary layman? These men may be honorable enough in their respective callings so far as that is concerned, but surely they are not entitled to wear the uniform of the American soldier, and it is doubtful if such action would be tolerated in any other country. It does not tend to make the uniform respected either by the men of the service or the public in general, and no doubt this is one reason why men in uniform are not welcomed in many public places.

There is a law restricting the use of the uniform to the men of the service. It should be enforced to the letter.

These are some of the reasons why young men do not join the National Guard. These are some of the things that should be brought before the powers that be at Washington.

Loading and Firing Submarine Torpedoes

SPEAKING broadly, the submarine is a gun and the torpedo is its projectile. Just as the field gun must be brought within range and trained upon the target, so must the submarine. The range of the submarine projectile varies according to the type which is used. The latest torpedoes, designed for long range firing, have a range of from seven to ten thousand yards. These are used on battleships, cruisers, destroyers, and other surface vessels. The submarine torpedo is of a special type, designed to deliver an unusually large charge of explosive at short range.

Experience had during the present war seems to show that it is extremely difficult to secure a hit against a fast-moving ship at a range of several thousand yards, and this in spite of the fact that the most recent torpedoes have a speed of 40 knots. This is explained by the fact that in order to secure a hit on a vessel which is moving athwart the course of the vessel which does the firing, it is necessary to aim the torpedo a considerable distance ahead of the moving ship, so that the torpedo and the ship shall reach the same point together. In order to secure accuracy, therefore, it is necessary to know the speed of the enemy and his distance with a very close approximation. It has been estimated that during the first battle in the fight off Heligoland there were over fifty high-speed ships engaged, all of which were using the torpedo freely. The battle, even if the intermission be omitted, lasted several hours; and yet not a single torpedo hit was recorded.

The successful torpedo work in the present war has been done almost entirely by submarines; and this, of course, is due to the fact that the submarine, because of its invisibility, is able at times to get so near to the course of a passing ship that it can fire its torpedoes at ranges of from say 500 to 1,000 yards, at which, if the officer in command of the submarine is at all capable, a hit should readily be made.

The submarine torpedo, that is to say, the torpedo used on submarines, because of its short range requires less air capacity and smaller engine power than the ordinary type, and the weight thus saved can be put into the charge of explosive, which, in the case of the latest German submarines, amounts to 420 pounds of extremely powerful trinitrotoluol. One successful hit by such a weapon will probably sink any ship afloat; for not only will an enormous rupture be made in the hull of the vessel at the point of contact, but the expansive energy of the gases within the hull will so strain and start the seams of the bulkheads in the vicinity of the explosion, that the ship, if she does not go down at once, will be filled by the gradual seepage of the water, and must ultimately founder.

Our front page engraving shows the front end of a typical submarine, which is provided with four torpedo tubes, grouped in the nose of the boat and parallel to its longitudinal axis. The tube, or gun, consists of a stout and strong bronze cylinder, into which the torpedo fits with a contact sufficiently close to prevent the escape past the torpedo of the charge of compressed air with which the torpedo is fired, and insure its being forcibly ejected from the tube. The torpedo, of which the latest submarines will carry from eight to twelve, is picked up by a chain hoist and swung in front of the breech on the tube, and then pushed home by the crew. The hinged door at the breech, answering to the breech-block of a gun, is then swung to, and locked by turning the hand-wheel shown in the engraving. Another hinged door at the muzzle of the tube outside the submarine is lifted, and a charge of compressed air introduced at the back of the torpedo serves to fire it. As the torpedo passes down the tube, a small lever projecting from the torpedo is tripped and thereby admits the compressed air which drives the turbine engine of the torpedo.

The tube being fixed firmly in the hull of the submarine, it is necessary to train the submarine itself directly on its object, or somewhat ahead of it, as the case may be. This is a difficult maneuver and calls for quick work with the rudder. Sighting is done by means of the periscope.

The Current Supplement

THERE is a gratifying variety in the matter contained in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2056, for May 29th, 1915. Some excellent pictures and a short article describe a new railway that has been built through a particularly picturesque region of the Alps from the Rhône to the Rhine. In the solider line is a valuable article on the Development of Electromagnetism, which reviews some of the newer important problems. The Protection of the Strong discusses the results of the practical working of systems for protecting the poor and covers an interesting sociological question. Making Museums Useful will appeal to every reader interested in educational matters. The impression the public has heretofore had of museums appears to be that they are merely decorative public buildings, but this writer points out forcibly the great educational value of even a small museum, intelligently arranged and conducted, even where resources are limited and the outfit inconspicuous. The History of Opium gives a large amount of historical and technical information that is both interesting and useful. There is another of Sir J. J. Thomson's remarkable lectures on Atoms and Ions, which give the most complete exposition of the subject that has been published. The description of the European aeronautical laboratories is concluded, and there are a number of shorter articles of interest.

Pavement Patent Sustained

BY a recent decision of the Supreme Court of Alberta the Canadian patent to Warren Brothers for the wearing surface of street pavement, known as the bitulithic pavement, was sustained. The case arose over a paving contract in the city of Calgary undertaken by the Canadian Mineral Rubber Company, Ltd., in which there was practically no question as to there having been an infringement, and the matter before the court was as to the validity of the patent, No. 88,116, which is identical with U. S. Patent No. 727,505; and this was fully sustained by the court. This is the first case under the Canadian patent, but the United States patent has been sustained in several decisions.

Another decision that has recently been rendered in relation to this pavement was in a case where the city of Rochester had specified this pavement, a proceeding which it was claimed was prohibited by the charter. The court decided that this was a distinct "kind of pavement" and was not "a particular kind, make, style, or brand of material" which could not be specified under the charter.

Home-made Fire Extinguishers

IN many situations, especially in rustic localities, an abundance of hand grenades for extinguishing fire is a very necessary precaution. Many persons who hesitate to provide themselves with sufficient store of these because of the expense will be glad to know that they can easily be manufactured at home at a trifling cost. A late number of *La Nature* gives three new inexpensive formulas for solutions which make excellent grenades when placed in mineral water bottles, which are easily broken when required.

Hagnard grenades are flasks containing not quite a liter of the following solution:

Calcium chloride	157 grammes
Magnesium chloride	56 grammes
Water	797 grammes

Howen grenades contain a scant half liter of the following solution:

Marine salt	200 grammes
Sal ammoniac	90 grammes
Water	710 grammes

The Schwenberg "Death to Fire" grenades contain a trifle less of the following mixture:

Marine salt	65 grammes
Solvay salt	17 grammes
Water	928 grammes

A Novel "Get Out and Get Under."—Patent No. 1,136,327 to Frank A. French of Pittsburgh, Pa., provides a repairman's truck which is adapted to receive a repairman and his tools and is low enough to roll under an automobile. It also has a convenient headrest and is designed to add to the comfort and facilitate the work of the repairman.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Rufus Porter, Founder of the Scientific American

To the Editor of the SCIENTIFIC AMERICAN:

My acquaintance with Rufus Porter began a comparatively short time before his death.

In 1879 I was running a printing office in Meriden, Conn., and a man came in one day, and asked about some printing which he wanted. He had a fiddle-bag, and a fiddle in it, and I judged him to be one of the old-time fiddlers and dance masters.

He seemed advanced in years, and yet not an old-appearing or an old-acting man. I would have placed him at about 65 to 70 years of age, instead of the 89 or so which he actually was. He was of medium height, not over 5 feet 6 or 7 inches, I judge, eyes of light blue or gray, as I remember them, not requiring glasses, except for reading. The general impression that he gave was that of sturdiness.

He had evidently a well-stored mind, and was an interesting talker on the subjects of conversation which came up in our interview.

Such was Rufus Porter, founder of the SCIENTIFIC AMERICAN, a typical Yankee of the old school, one who could turn his mind and hand to many things.

He wanted some printing to use, and as he was lacking money, he wanted to make an exchange of some service he could render to pay for it, and feeling an interest in the old man, I allowed him to paint a sign, and did him the printing he wanted. Afterward he came again, and wanted to exchange a fiddle and a spy-glass for some more printing. I accommodated him, and kept them for more than a dozen years afterward. I was told by some one who knew him that Porter never used the cars in his travels, but always trudged on foot to his destination. I think that he would have tired out many a younger man.

It may be of interest in these days of the automobile and its tremendous development to know that Rufus Porter was working on the plans of an automobile, and was planning to form a company to manufacture the same.

He showed me the sketch of one, neatly drawn on brown or buff drawing paper. A steam carriage, he called it. The plan was that of an ordinary carriage, with a boiler placed underneath, and using oil as a fuel. The engine was of the rotary principle, with chain drive.

Such was his outlook at his advanced age.

In the non-utilization of his capabilities the world suffered an economic loss. He ought to have had a conservator over him in the shape of a captain of industry, or of some syndicate, who would have kept Porter's fertile mind at work on new ideas, backing them up with capital and business push, and then the world would undoubtedly have been the gainer.

Richard M. Hoe.

In strong contrast to Rufus Porter was another man, whom I met about three years after meeting Porter; this was Richard M. Hoe, head of the great printing machinery firm of R. Hoe & Co.

Mr. Hoe came into fame by reason of his noted invention of the type-revolving printing press about the time of the founding of the SCIENTIFIC AMERICAN. His main patent was issued in 1844, the year previous to the founding, and another important one in 1847. As I remember him, Mr. Hoe was a small man, probably not larger than Rufus Porter. He attained fame and fortune; Porter did not, yet I am inclined to think that the latter was fully as richly endowed mentally as the former, and even more so in physical toughness.

Mr. Hoe was brought up in a business of which he became the head, and in it he spent his life. He made a remark which may be considered as an epitome of his life-work in contrast to Porter's. In our conversation I expressed my doubts as to the probability of machinery being ever built absolutely perfect. Mr. Hoe deliberated a moment, and then said, "Well, we try to get down a little closer, a little finer each year, and we think that we do it."

Mr. Hoe gave to the world his best, and was an economic success. The conception of Rufus Porter—a journal for the diffusion of scientific knowledge—was a rich conception for humanity: by the labors of those who continued the SCIENTIFIC AMERICAN this one production of his was redeemed from failure, and has been a splendid economic success.

Hartford, Conn. RICHARD ATWATER.

In a patent, 1,137,393, Newell T. Fogg of Sanford, Me., discloses an apparatus for throwing the rays of sunlight into the throat and surrounding parts for the purpose of killing bacteria which may have secured a lodgment therein.

A Mercury-Vapor Engine

Increasing the Efficiency of a Heat Engine by Employing a Liquid of High Boiling Point

TO the layman the word *thermodynamics* suggests something abstruse, something perhaps remotely connected with practical things. Yet one of the fundamental conclusions from the principle of thermodynamics is as intensely practical as it is unexpected. The maximum efficiency of a heat engine working between a temperature t_2 of the boiler and t_1 of the condenser is wholly independent of the working substance (steam, hot air, gasoline, etc.), and depends solely on the temperatures t_2 and t_1. It is a common fallacy, among persons not well versed in these things, to suppose that for an engine working at a low temperature (as for example in the exploitation of the sun's radiation) some volatile substance, such as ether, would offer advantages over water. As already stated, this is not the case, the efficiency is wholly independent of the nature of the working substance, given a stated temperature of boiler and condenser.

Yet Mr. W. L. R. Emmet, working in the research laboratories of one of our most progressive industrial enterprises, has recently spent much time and effort developing an engine which uses the costly element mercury in place of water in the boiler. How is this to be harmonized with what was said above? The explanation is simple enough. It is true that the theoretical maximum efficiency of a steam engine working between, say, 677 deg. Fahr. (the boiling point of mercury at atmospheric pressure) and 100 deg. Fahr., would be exactly the same as that of an engine in which mercury vapor took the place of steam. *But*, a steam engine working at such temperatures would be impracticable, owing to the enormous pressure to which the boiler would be subjected. A mercury vapor engine can be, and has been, built to work effectively at the high temperature stated. And the higher the boiler temperature, the greater the efficiency.

To recapitulate, the nature of the working substance has no *direct* influence upon the efficiency of the engine. Indirectly it affects this efficiency, in so far as it determines, owing to practical considerations, the temperature at which the engine can be worked.

This, then, is one reason for Mr. Emmet's labors in perfecting a mercury vapor engine.

But there is another point to be considered. The steam engine, as commonly operated, is extremely wasteful in one particular: The combustion of coal furnishes a temperature of some 2,700 deg. Fahr. The proper conditions are, therefore, presented for obtaining a high thermodynamic efficiency. But owing to the properties of steam a large amount of heat must be allowed to go to waste through the stack, and, though a temperature of 2,700 deg. Fahr. is available in the furnace, actually only about 600 deg. Fahr. (using a superheater) can, at the very best, be made use of in the cylinder. Now Mr. Emmet does not propose to work his mercury vapor independently, but to intercalate it between the furnace and the steam boiler, so that all the advantages of the steam engine will be obtained as before, and the additional power furnished by the mercury vapor engine will be a net gain.

Whether the type of engine developed by Mr. Emmet is destined ultimately to figure prominently in industrial operations is perhaps at the present moment somewhat open to doubt. The prospect seems fairly promising, as will be seen from the description given below. In any case Mr. Emmet's engine presents many features of the very highest interest, owing to the peculiar conditions which have been faced and the ingenious manner in which the problems involved have been solved.

The method applied in his process is described by Mr. Emmet in a paper read before the American Institute of Electrical Engineers, as follows:

"Mercury is vaporized in a boiler heated by a furnace of ordinary type. From this boiler (see Fig. 1) it passes at a pressure near or not much above the atmosphere, to the nozzles of a turbine which drives a generator or other utilizer of power. From this turbine it passes to a condensing boiler where it is condensed on the outer surface of tubes which contain water, and this water is vaporized by the heat delivered, and the steam produced is used to drive other turbines or for any other purpose. This condensing boiler is preferably placed at a level above the mercury boiler, so that the condensed liquid will run back into the mercury boiler by gravity without the aid of a pump. Since the mercury vapor is much hotter than the steam, the gases will normally leave the mercury boiler at higher temperatures than they have in leaving a steam boiler. To utilize this excess heat in the gases, it is proposed to convey them, first, after leaving the mercury boiler through a heater which raises the returning liquid almost to the boiling point; second, through a superheater which superheats the steam delivered by the condensing boiler; and third, through an economizer which heats the feed water for the condensing boiler and so reduces the gases to the lowest practicable flue temperature.

"By careful study and experimental development, means have been devised for reducing the amount of mercury used, for effectively preventing its loss or dissipation, and for immediately detecting any failure in such prevention."

Mr. Emmet then goes on to discuss the disadvantages and the advantages of mercury for a heat engine.

"The disadvantages of mercury for such a process are: First, that it is very expensive, its cost being about 60 cents per pound. Second, that it is poisonous and is capable of pervading the atmosphere in a very finely divided state in the neighborhood of places where the vapor can escape. Third, there are certain difficulties in confining both the vapor and the liquid, although these, with proper methods, are not serious.

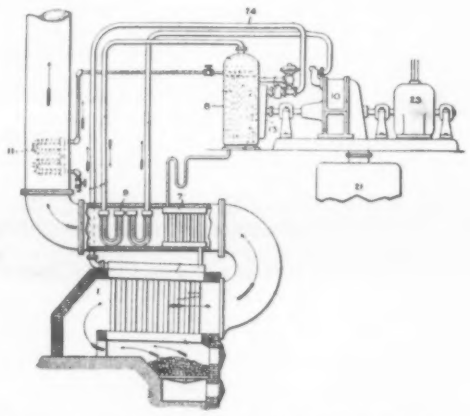


Fig. 1.—Diagrammatic view of apparatus to generate power.

1, mercury vapor boiler; 7, heater for liquid mercury; 8, condenser boiler; 9, superheater (steam); 10, steam turbine; 11, feed water economizer; 13, mercury turbine; 21, steam turbine condenser; 23, electric generator; 24, mercury vapor pipe.

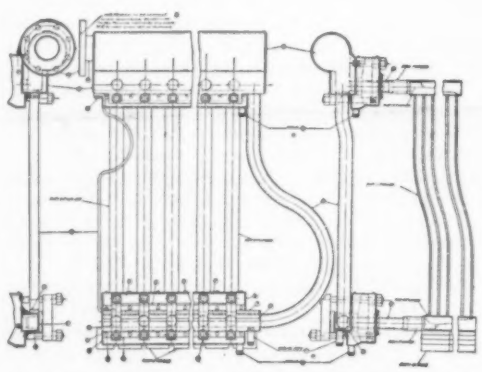


Fig. 2.—Assembly of experimental mercury boiler.

Fig. 3.—Second experimental mercury boiler tube.

"Mercury's advantages as a thermodynamic fluid for the purpose desired are many. First, its boiling points at desired pressures are convenient. Second, its high specific gravity makes possible the use of gravity feed, sealing of valve stems, etc., and centrifugal sealing of turbine packings. Third, it is completely neutral, at the temperatures used, to air, water, iron, and such organic substances as it may come in contact with. Fourth, it carries nothing in solution which can adhere to or affect heating surfaces, consequently the interior of boiler is always perfectly clean. Fifth, its vapor density is so high that it gives a very low spouting velocity, and consequently a very simple type of turbine can be used. Sixth, it does not wet the surface of turbine blades and consequently gives apparently no erosion. Seventh, its volume at convenient condensing temperatures is such that it can be used in turbines without excessive bucket heights. One of the greatest limits of design in steam turbines is the large area required for the efficient discharge of the low-pressure steam. With mercury vapor, this difficulty does not exist. Eighth, delivering its heat at the temperature and in the manner which it does, the condensing boiler in which this heat is used to make steam is very small and simple as compared with a steam boiler. Steam boilers transmit an average of about 6 watts per square inch with an average temperature difference of about 1,100 deg. Fahr. A surface condenser transmits 18 watts per square inch with 20 deg. Fahr. temperature difference. The mercury boiler is about equivalent in dimensions to a surface condenser, and since there is no high temperature involved, there will be no possibility of scaling or burning. High temperature, unequal distribution of heat, and the necessity for large heating surface constitute the principal difficulties of boiler construction. All of these are overcome in this method of making steam."

As regards the economy to be gained by his process, Mr. Emmet remarks:

"Before entering into the details of experiments or of the methods by which it is hoped to accomplish these results, it may be well to state the degrees of economy which should be accomplished if this development succeeds. Assuming heat deliveries to surfaces exposed equal to those in steam boilers under equivalent conditions of temperature difference, gas velocity, and radiation, and assuming a turbine efficiency equal to that of steam under equivalent velocity conditions, the calculation shows that in an efficient modern power station the same amount of steam can be delivered to the turbines at the same superheat, thus giving the same turbine output, and that in addition about 66 per cent of the power so delivered can be delivered by mercury turbines, the fuel required being only about 15 per cent greater than that which would be used with the steam alone. Thus the gain in capacity of an existing station would be approximately 66 per cent and the gain of output per pound of fuel would be about 44 per cent. This calculation is based upon a mercury vapor pressure 10 pounds above the atmosphere and a vacuum of 28.5 inches at the steam turbine outlet.

"About 10 pounds of mercury would be evaporated for each pound of steam produced, the steam pressure being about 175 pounds gage, superheat 150 deg. Fahr., and the final temperature after gas leaves economizer being about 300 deg. Fahr. The vacuum in both steam and mercury turbines can be maintained by the same air pump, means being employed to separate all mercury vapor from the air in a suitable cooler.

"Experimental data indicate that not more than $10 worth of liquid mercury per kilowatt output of mercury turbine will be required for such a process, and it is probable that with suitable arrangements, this amount can be considerably reduced. The general application of such a process would require immense quantities of mercury, but inquiry has indicated that the sources of supply are such that the largest conceivable demand for such a purpose would not permanently increase the price."

Mr. Emmet then proceeds to describe his mercury boiler:

"With a view to developing a design for a mercury boiler which would produce the vapor with the practicable methods of firing without destructive temperatures in the steel and with a small total amount of mercury in use, it has been necessary to do much experimenting to determine the behavior of mercury under boiler conditions. The construction of the boiler as finally developed is shown by Fig. 2, and the experimental unit used to determine its characteristics is shown by Fig. 3.

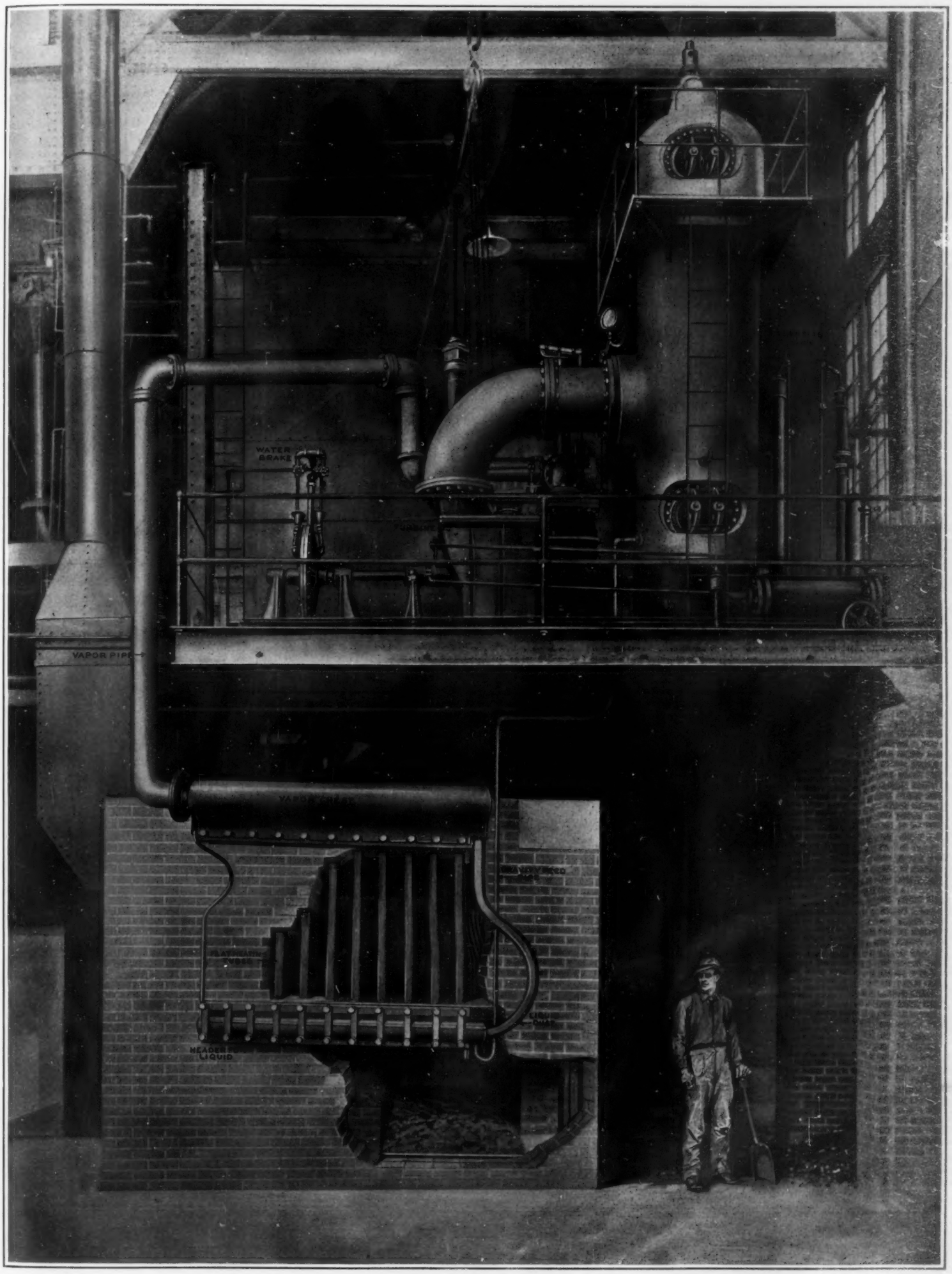
"This boiler is made up of a number of heating units, each consisting of an upper and a lower header which are connected together by curved flattened tubes. The flattening is to reduce the space which must be filled with liquid mercury without diminishing the surface. The curvature is to prevent mechanical strains through unequal expansion caused by irregular heating. These flattened tubes are connected into the headers by acetylene-welded joints. The tubes are first welded from the inside into channel-shaped pieces; these channels with the set of tubes connecting them are then annealed so as to release all strains incident to the welding. After annealing, they are tested with high-pressure air, suitable clamps being used to confine the air in the channels. These channel pieces are then welded to steel headers so that the whole unit becomes perfectly tight and capable of standing a high pressure. The headers of these units terminate in taper nozzles, which fit into taper holes in the bus header at the bottom and into a vapor chest at the top. A curved liquid duct connects the vapor chest to the bottom header at the hot end so that the heating units which are exposed to the greatest heat receive the most direct supply of liquid. In these hot units, a larger internal space will be allowed than in the units which occupy the cold part of the boiler, so that the colder part will not carry an unnecessary amount of liquid.

"The arrangements of the turbine have been improved as the result of experience. The first turbine arranged was made from an old experimental steam turbine, and had many joints which were difficult to keep vacuum-tight. The new experimental turbine has only one joint, arranged in a manner which has been experimented with and which will avoid leakage.

"The condensing boiler used in the experiment now in preparation is made from a standard high-pressure feed heater having a water space at the top and bottom connected by tubes in the manner customarily used in such devices. This boiler has apparently worked satisfactorily and produced steam from mercury vapor in the manner expected. It is not, however, considered a suitable design for the purpose, since the temperature differences impose a strain on the expanded tube sheets. It is thought that tubes attached at one end with concentric circulation after the manner of the Nicholaus boiler will afford the most satisfactory method

for such condensers. Since no violent temperature differences will exist, it is believed that these condensing boilers can be made practically free from deterioration and entirely free from leakage."

The Kashmir Shawl Industry has not only declined since the days of our grandmothers, when it gave employment to over 60,000 people, but has also sadly deteriorated, according to Consul Henry D. Baker, who has been writing a series of able and voluminous reports on the commercial and economic conditions of all parts of the Indian Empire. France was formerly the best market for these shawls, and the industry experienced its greatest setback from the calamities attending the Franco-German war. Many of the best shawl weavers have left Kashmir and settled elsewhere, while others have taken to carpet making or embroidery. French patterns and new colors, such as magenta, are beginning to prevail over genuine Indian designs and colors, and the goods are rather cheap and showy instead of being real works of art as heretofore.



A MERCURY-VAPOR ENGINE

The Heavens in June

Studying the Acceleration of the Moon

By Henry Norris Russell, Ph.D.

IN certain branches of astronomical research there has gone on for centuries a rivalry between the observer and the mathematician, which Prof. Brown of Yale has wittily compared to the contest between the makers of cannon and armor-plate. The mathematican, equipped with the tools of modern analysis, attempts to forge an invulnerable theory of the matter of some heavenly body—for example, the Moon—while the observer, to test the strength of the theoretical construction, batters at it with an ever-growing artillery of observational facts. But in this friendly contest the observer has a great advantage; in Prof. Brown's phrase, he has "a gun whose power increases with the time." However accurately the theorist may calculate the future course of the Moon, knowing only that at a given time it was in a certain position and moving in a given direction and at a given rate, he must depend upon observation to tell him what this position and this speed was; and it is clear that, the longer the interval of time over which our observations of any moving object extend, the more accurately we can determine its rate of motion. It is for this reason that the few ancient observations of the Moon which have come down to us, though made with the unaided eye, and very roughly, are still of importance. If her motion were exactly uniform, after correction for the well-known periodic "inequalities" which set her alternately forward and backward at regular intervals, it would be possible to work out its rate so accurately from the telescopic observations of the past 150 years that we could carry it back to classical times and compute her position then more clearly than the observers of that day could possibly have observed it. But, as a matter of fact, the Moon's motion shows a small but undoubted "secular acceleration," which means that, from century to century, she appears to move a little faster in the sky. The effect in any one lifetime is very small. The length of a month (measured by the Moon's motion among the stars), which in 1900 was 27 days, 7 hours, 43 minutes and 11.493 seconds, is steadily decreasing, but it will take 3,400 years to change it by a single second.

It may seem incredible that so small a change can be detected at all; but its influence is cumulative, and increases with the square of the time, so that for a long interval it is important. Two thousand years ago, for example, the month was six tenths of a second longer than to-day. Its average length throughout the twenty intervening centuries must have been three tenths of a second more than at present. But in this time there were almost 27,000 (sidereal) months, so that the total effect of this small change in the length of each amounts to about 8,000 seconds, or more than two hours. If, then, we calculated the Moon's position 2,000 years ago, ignoring this change, and carrying its motion back at its present rate, we should go wrong by about 2¼ hours' motion of the Moon, which amounts to 1¼ degrees. This is more than twice the Moon's diameter, and could not fail to be recognized by the naked eye if good sky-marks were near the Moon, in the shape of neighboring stars, or if observations were made at the time of an eclipse.

For more than two hundred years, since the time of Halley, it has been known that the Moon's motion presented this peculiarity; but the determination of the exact amount of the change is very difficult.

The latest word upon the subject, published but a few weeks ago, comes from an English chronologist and astronomer, Dr. Fotheringham, who has worked out anew the results of certain ancient observations, recorded by Ptolemy in his classic treatise known to us under the Arabic name of the Almagest. In this work, written in Greek at Alexandria about 140 A. D., are recorded a number of observations of occultations of stars by the Moon, or close approaches of the Moon to certain stars, with such clear statements of the place, year, date, and hour of observation that there seems to be no doubt of their meaning. Seven such observations, the earliest made at Alexandria by Timocharis in the year 293 B. C., the latest at Rome in the reign of Trajan, in 98 A. D., are given by Ptolemy, and it is from these that Dr. Fotheringham has derived the value of the change in the length of the month which is given above. The average outstanding discordance between the positions of the Moon so calculated and those described by the ancient observers is slightly over a quarter of a degree. It is probable that most of this discordance arises, not from the estimates of the Moon's position relative to the stars, which could be made under favorable conditions with much smaller errors, but from the difficulty of determining the time of observation with the very imperfect means at the disposal of the ancients. It is believed that the time between the moment of observation and the preceding sunset—or the following sunset, in case of a morning observation—was measured by means of a water-clock. From the magnitude of the discordances, Dr. Fotheringham concludes that these small water-clocks, on the average, ran wrong by about twelve minutes per hour!

In spite of these difficulties which beset the work of the ancient astronomers, these few recorded observations suffice to fix the rate at which the month is growing shorter with a "probable error" of about one fifteenth of its own amount. If only we had all the observations on which they based their own calculations, we would be better off, as is shown by the fact that Hipparchus, fully 250 years before Ptolemy, was able to determine the length of the sidereal month (the average period of revolution of the moon among the stars) within two seconds of time—that is, within a millionth part of its true value—and the length of the synodic month (from new Moon to new Moon) within a small fraction of a second.

The ancient observations of eclipses show that the Moon's daily motion, compared with the Sun's, is also growing more rapid, but at a slower rate than the motion compared with the stars, so that the Sun, too, must be moving a little faster per day through the heavens than once it did. According to Fotheringham, who substantially confirms an older investigation by Cowell, the Sun's "secular advance" amounts to about three seconds at the end of a century, which corresponds to a shortening of the year by a second and a half every century.

What the reasons are (so far as is known) for these singular changes in the lengths of the month and year we must leave to be told next month, only remarking here that, since we use the Earth's rotation as the standard in all our measures of time, a minute increase in the time required for this rotation, i. e., in the length of the day, would make the number of days in a month or a year smaller, and so cause an apparent decrease in their length, due only to the slowing of all our clocks.

At 11 o'clock : June 7.
At 10½ o'clock : June 14.
At 10 o'clock : June 22.

At 9 o'clock : July 7.
At 8½ o'clock : July 14.
At 8 o'clock : July 22.

At 9½ o'clock : June 30.

NIGHT SKY: JUNE AND JULY.

The Heavens.

As our map shows, the most brilliant part of the sky is now in the southeast and south. Its splendor arises less from the bright stars within its confines than from the magnificent region of the Milky Way, which extends from Aquila southward through Sagittarius into Scorpio. The great star-clouds in this neighborhood send us far more light than the individual bright stars in their vicinity, yet most of their light comes from stars too faint to be seen with any but the largest telescopes. The possessor of even a small instrument, however, will find innumerable fine star-fields and many beautiful nebulæ and clusters, which will richly repay his study. One cluster in particular, between λ Scorpii and γ Sagittari, is a splendid object, even in a field-glass.

Scorpio itself, now fully in sight, with the sweep of its tail curving down to the southern horizon and upward again, is the finest constellation in view. Following the Milky Way upward and to left, we reach Sagittarius; then, beyond the star-clouds, Aquila; later Cygnus, with Lyra above, and finally Cassiopeia, low in the northeast. Draco and Ursa Minor are high in the north, and the Great Bear is fully displayed in the northwest. Leo is due west and near setting, and Virgo is higher up, in the southwest. Boötes, Corona, and Hercules are grouped about the zenith, and Ophiuchus and Serpens are on the meridian in the south.

The Planets.

Mercury is evening star until the 26th and morning star after that date. He is well visible during the first week of June, when he sets a little after 9 P. M., but disappears in the twilight before the middle of the month.

Venus is a morning star in Taurus and is now pretty near the Sun, rising at 3:10 A. M. in the middle of the month, just before daybreak.

Mars is likewise a morning star, in Aries and Taurus, rising about an hour earlier than Venus.

Jupiter is in quadrature with the Sun on the 19th and is due south at 6 A. M. on that date. He is in Pisces, close to the vernal equinox, and rises about 1:15 A. M. at the beginning of the month and 11:30 P. M. at its close.

Saturn is an evening star in Gemini and is very close to Mercury at the beginning of the month, but later falls below him in the sky, so that he will be the first of the two to be lost to view. On the 28th he is in conjunction with the Sun and becomes a morning star.

Uranus is in Capricornus, and comes to the meridian at 3:40 A. M. in the middle of the month. Neptune is in Cancer, visible in the early evening at the beginning of the month, when he sets at about 10:30 P. M., but lost in the twilight before its close. The Moon is in her last quarter just before noon on the 4th, is new at 2 P. M. on the 12th, in her last quarter at 9 A. M. on the 20th, and full at 11 P. M. on the 26th. She is nearest us on the 26th and farthest away on the 11th. She is in conjunction with Uranus on the 2nd, Jupiter on the 5th, Mars on the 9th, Venus on the 10th, Saturn on the 13th, Mercury on the 14th, Neptune on the 15th, and Uranus again on the 29th. The conjunctions with Uranus are close, but not observable from this part of the world; the others are wide.

At 7 A. M. on the 22nd the Sun reaches his greatest northern declination, and, in the phrase of the almanacs, "summer commences."

Comets.

Mellish's comet, though a fine circumpolar object this month for southern observers, has disappeared from our view, to return only as a telescopic object, when it regains a declination at which we can observe it. It is probable that it can be followed telescopically all this year and the next.

A new comet was discovered on May 16th by Delavan at La Plata, Argentina. Its position, as communicated by telegraph recently, was in 0 hour and 33 minutes Right Ascension and 2 degrees 5 minutes south declination, which places it in the constellation of Cetus, about 15 degrees east and 1 degree north of the present position of Jupiter. The comet is described as "visible in a small telescope."

No information regarding its motion is available at the date of writing.

Princeton University Observatory.

An old German hand-driven wheel-chair.

Measuring the Twisting Strength of Steel

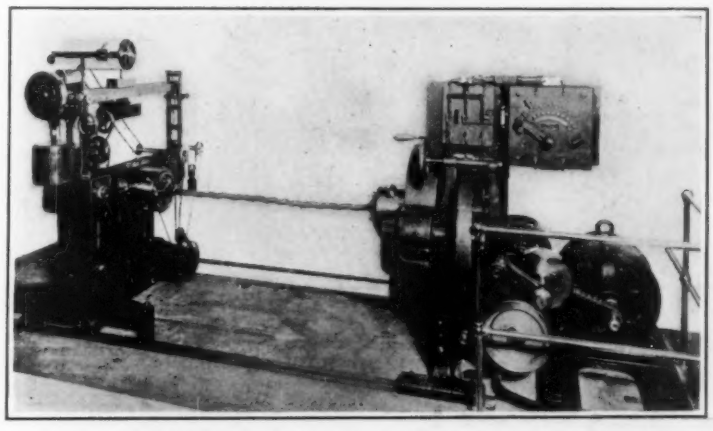
By Robert H. Moulton

THE manufacturers of a well-known motor car have just installed in their laboratory a new torsion testing device for measuring the twisting strength of steel. There is only one other machine of the kind in existence, which is now being exhibited at the San Francisco Exposition, and has been purchased by the Japanese Government.

The novel part of the machine is the autographic attachment, which records in ink the torsion curve of the particular part under test. Formerly this measurement was calculated more or less accurately by an attendant. The capacity of the machine is two hundred and thirty thousand inch-pounds. It will test round, square, flat, or irregular specimens from one eighth of an inch to two and one half inches in diameter, and up to eight feet in length.

The machine is operated by a variable speed motor and two systems of clutches. It is automatic and autographic, the balance weight being operated by an electric clutch, the curve of the autographic part being taken on a drum driven through differential gearing.

The specimen to be tested is placed in position in the jaws of the machine, the gearing thrown into operation, and from this point the human element does not enter, nor is the machine again touched by the operator until the broken pieces are removed. The autographic mechanism delivers a complete curve, showing the exact performance of the tested piece throughout the operation.



Machine for measuring the torsional strength of steel.

Model of the Typhus Carrier

THE horrors of pestilence, a vermin borne disease, in addition to the awful sufferings on the battlefield, is the latest shock of the present European war, for the dreadful scourge of typhus fever has already claimed thousands of victims in Serbia. This deadly pestilence of olden times, which must be clearly distinguished from typhoid fever, has almost disappeared from civilized countries in times of peace, and is a striking example of the relation between *cleanliness* and *health*. Typhoid fever was once confused with typhus fever, and when it was recognized as a different disease it was named typhoid because it was like the more common and more deadly scourge. Typhus fever was formerly also called "*camp fever*" and "*jail fever*," because it raged so terribly under the unsanitary conditions which prevailed in these and other vermin haunted places. In every century typhus fever has followed in the wake of armies. During the Thirty Years' war it claimed more victims than did the weapons of the contestants. It was the terror of the Napoleonic campaigns, and decimated the French army, already demoralized physically and morally by the terrible retreat from Moscow. During the Crimean war it decimated both the French and English armies, especially the former.

It was only six years ago that a French bacteriologist, Nicolle, followed by several American investigators, showed that the germ of this disease is carried from person to person, mainly by the bite of the louse and perhaps, at times, by other vermin.

At this opportune moment there is being constructed at the Museum of Natural History, New York, a realistic and most accurately enlarged model of this devastating pest. It was planned under the direction of Dr. C. E. A. Winslow, curator of the Department of Public Health, and will shortly be installed in the new hall of this section. It is to be shown along with other previous enlarged figures of the mosquito, fly, and flea, which have been described in this journal. These are to form a part of a new and comprehensive military hygiene exhibit illustrating the dangers of insect-borne and other camp diseases now being assembled under the supervision of Curator Winslow. This human welfare exhibit might be said to be the first attempt made in a pure Natural History Museum to regard man as after all one of the most important animals.

The model of the louse, an illustration of which is reproduced, is being prepared by Mr. Matausch, an accomplished preparator attached to the museum, and will show the insect magnified a million times.

Enlarged model of typhus carrier in the Museum of Natural History at New York.

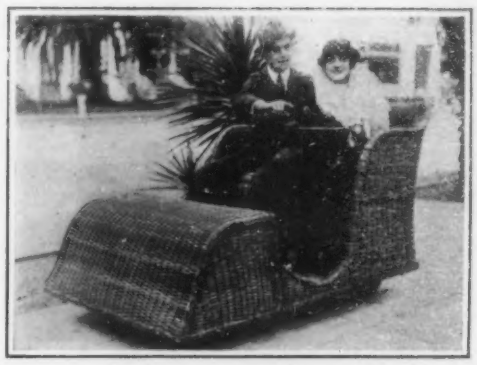
The Evolution of the Wheel-chair

WHEN the wheelbarrow came into general use in Europe in the middle of the thirteenth century, it was described as being, among other things, "a comfortable means of transporting invalids and other persons," and we see in an early print taken from a sixteenth century manuscript, what may, perhaps, be a prototype of that wheeled conveyance, man-pushed, seen on the Atlantic City boardwalk to-day!

Long antedating the awkward wheeled conveyance of the thirteenth century, "invalids and other persons," including the dark-eyed beauties of the Orient, traveled more or less elegantly in litters slung on poles and carried by four bearers. Due, no doubt, to the lack of dignity in barrow riding (since we are assured of its comfort) the use of the hand-pushed wheeled vehicle of the sixteenth century did not become popular, and we find a reversion to the old-time palanquin in that the typical light vehicle of the eighteenth century is the Sedan chair.

This chair was a portable box with side windows and a roof which opened to allow the occupant to stand when entering. It was entered by a hinged doorway in front, between the two poles by which a pair of chairmen carried it. These chairs were often beautifully decorated, some of the greatest French pastoralists embellishing the panels with the most exquisite paintings.

Sedan chairs, with the poles so arranged that the chair was not tilted, were also used to carry invalids up and down stairs from their beds to mineral baths, and in connection with various baths and health resorts the use of the wheel Bath chair resulted. One can readily understand how being trundled around in a Bath chair would fail to satisfy a craving for locomotion, for the development of the motor chair seems to have come about not solely as an expedient for moving invalids, but also from the desire for the pleasure of speed without exertion. And so, mankind having at length grown dissatisfied with palanquins, wheelbarrows, Sedan and Bath chairs, we find an article in the *Journal de Paris* for the 27th of July, 1779, announcing the invention of the first velocipede.



A twentieth century electrically-driven wheel-chair.

This swift and fearful vehicle consisted of a wooden bar rigidly connecting two wheels placed one before the other, propelled by the rider seated astride the bar and pushing against the ground with his feet. This rare machine was called the "Gentlemen's Hobby-horse," and immediately became so popular that it was followed by a "Ladies' Hobby-horse," which was built with a neat seat like a lunch counter stool rising from a low bar near the ground so that the lady might scuff the path in a seemly manner. The hobby-horse, however, was halted in his wild career by the melancholy accusation that "this form of exercise gives rise to a disease of the legs." Thereupon an arrangement was developed whereby the front wheel was rotated by a hand-crank, for strange to say, a gearing for foot power was not thought of until considerably later. An odd type of an old hand-driven wheel-chair appears in a German print in Feldhaus' *Die Technik*, which shows an enterprising gentleman evidently using all his energy to push himself along.

The motor chair seems to have come into existence in connection with the bicycle from the cyclist's desire to take along as a companion a lady or invalid who could not do a share in the propulsion, for we find the pleasant pastime advocated in *La Bicyclette* (1899) wherein is described a two-wheeled wicker chair attached to a bicycle.

A different aspect of chair cycling appears in 1890. This was what was known as the "Coventry chair," a spacious tricycle with wicker body, behind which a man sat on a sort of footman's seat and pedaled, steering by means of a handle running under the chair-body from the small wheel in front. This elegant vehicle was declared to "fully meet the requirements of those who move in the inner circles of society." Thus we see the inception of the actual motor chair, and it is only a natural sequence that four years later there appeared in *London Work*, "Will you please give full instructions as to how to drive an invalid chair by electricity?" to which the following answer was given:

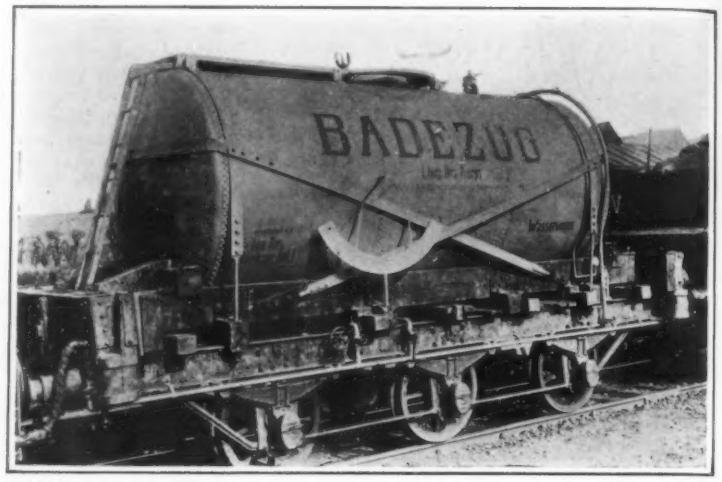
"To do this a motor that would develop about a quarter horse-power would be required, and this would have to be driven by means of accumulators. You would, I am afraid, find that the accumulators would take up a lot of room in the chair, and if you had no means of recharging them, you would require an engine and dynamo. I think that you will find the cheapest and most satisfactory way is to hire a boy to push the chair."

This suggestion, however, was a forerunner of the present day electric wheel-chair, which, however primitive it may appear a century hence, is certainly a marvel of ingenuity beside the hobby-horses of the past, and would have seemed a piece of witchcraft in the days of the early wheelbarrow.

This unique vehicle is attracting much attention just now at the San Francisco and San Diego Panama-Pacific expositions where several hundred are in opera-

(Concluded on page 502)

Bathing train of the German army.



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The bathing water tank car.

Mobility in Modern Warfare

THE accompanying random pictures will give some idea of what is demanded in the way of mobility in modern warfare. In Poland, where railroad facilities are very meager and roads are almost impassable in stormy weather, the warring armies have been confronted with almost insuperable difficulties. Motor trucks and powerful tractors have done heroic work in these emergencies. One of these tractors, an enormous gasoline-propelled machine, is shown herewith. It has been used by the German army for the transportation of heavy guns and trains of supply wagons.

The battery of guns mounted in armored cars was photographed in Flanders and shows how the Allies are enabled to move their artillery quickly from one point to another as occasion demands.

The other two photographs are of a more peaceful character, but also have to do with mobility.

The German army has in use a train specially constructed for bathing, which can keep closely in touch with the men at the front. The train consists of a locomotive, tender, water tank car, three cars fitted up for hot baths, and several cars fitted with separate compartments. The tank car contains about 2,300 gallons of water, and about fifty soldiers can bathe at a time.

Log Train Locomotive

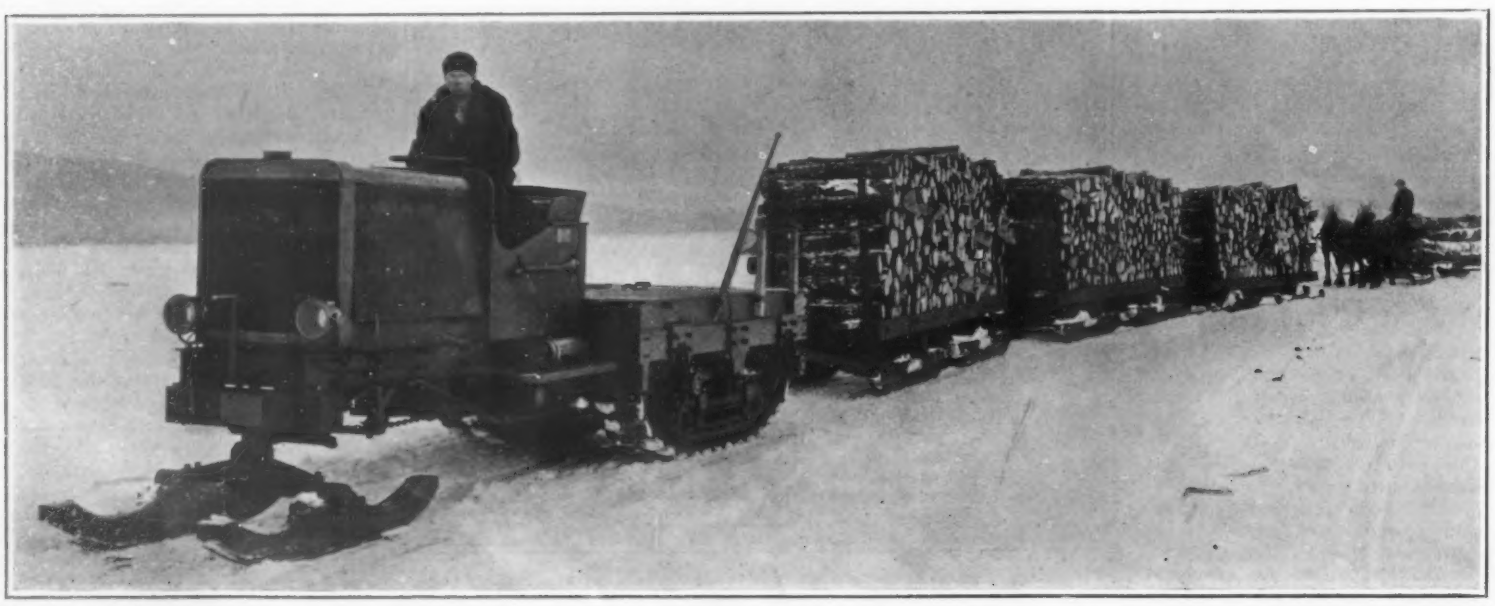
GASOLINE has displaced steam at Brewer Lake, Maine, for hauling logs out of the North Woods. The accompanying photograph shows an interesting tractor on sled runners, which is equipped with a caterpillar type of propeller driven by a powerful gasoline engine. Caterpillar traction is ideal for travel through snow. The machine weighs seven tons as against thirteen or more, which is the common weight of the steam tractor. Some time ago this machine was wrecked by breaking through the ice of the lake when it encountered a triangular crack. The tractor went to the bottom, carrying with it the driver, who was drowned. The water is about fifty feet deep at that spot. However, the machine was raised and repaired. It is still at work when the ground is covered with enough snow, and can haul twenty cords at a load over common roads and bad hills.

Huge German tractor used in Poland.

Allies' mobile battery in Flanders.

Making Electromagnets.—An electromagnet is one of the most difficult things for an amateur to make without the use of machine tools. To make an electromagnet entirely by hand, the core is made of strips of thin sheet iron cut to the required size and assembled. A spool is made from sheet zinc by tracing out a figure that will fold around to make a square section to envelop the core, while the four ends are bent out at right angles to form the spool flange. But as such flange is incomplete, it is reinforced and also insulated by a heavy cardboard split washer which is fitted on. Wood should always be avoided on account of breakage. The main part of the spool can be insulated by a paper wrapping. Such a laminated magnet has the advantage of being flexible, and the poles can be spaced at different distances apart.

A Novel Ball Rolling Toy.—Domenico Ronconi of Chicago has patented (No. 1,132,796) a toy in which doll figures are seated one at each end and one at the middle of a table and motor mechanism beneath the table operates the arms of the dolls at the table end to roll a ball back and forth between the end dolls and also moves the head of the intermediate doll to cause it to appear to follow with its eyes the movement of the rolling ball.



A gasoline caterpillar tractor hauling a log train at Brewer Lake, Maine.

RECENTLY PATENTED INVENTIONS

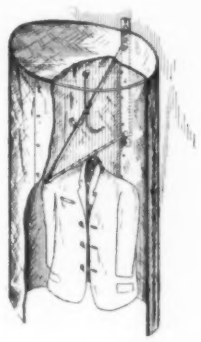
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

APRON.—G. A. STEINER and W. F. TUCKETT, 33 E. 6th South St., Salt Lake City, Utah. This invention has reference particularly to aprons worn by butchers, bakers, waiters, bartenders, etc., and it is the object of the improvement to prevent the tangling and tearing of the tapes or tie strings during the washing process.

COSTUMER.—T. P. FORMAN, 95 Bank St., Waterbury, Conn. The standard or stem of the costumer is a tubular metallic member having integral feet formed at the bottom thereof by splitting the tube longitudinally and spreading the split portions outwardly and downwardly in radial relation to the stem, so as to provide a wide supporting base, the upper end of the stem having a head provided with a series of large and small hooks for supporting coats, hats and the like, said head being formed integral with the tubular stem or separate therefrom.

WARDROBE.—H. A. ROAT, JR., 1007 N. 3rd St., Harrisburg, Pa. The object in this invention is to provide a device especially designed for travelers, and having mechanism for permitting it to be easily attached to a fixed support or detached therefrom, and capable of folding into small compass for transportation and storage, and providing when in place protection for a number of garments of different character.



WARDROBE.

UNDERWEAR.—R. D. OILAR, Indianapolis, Ind. This invention has for an object to provide a garment having the characteristics of a union garment and form separable parts arranged end to end. It provides underwear substantially continuous throughout but separable substantially centrally, whereby there will be an upper and lower garment or part when separated.

Electrical Devices.

TERMINAL CONNECTION FOR SPARK PLUGS.—J. P. BLAUVELT, 234 North Broadway, Nyack, N. Y. This invention provides a terminal connection for spark plugs and similar devices arranged to permit of convenient attachment of a clip to the central electrode member of the spark plug and to prevent losing of the nut employed for fastening the clip in position on the spark plug.

SPARK PLUG.—J. A. GILBERT, Box 163, Cocoa, Fla. This invention provides a plug which is capable of giving a multiplicity of sparks, thereby insuring the explosion of gas in the cylinder upon which the spark plug is located. It provides a spark plug having a plurality of spark gaps in series, these gaps being arranged in a substantially circular arc around the bottom of the plug.

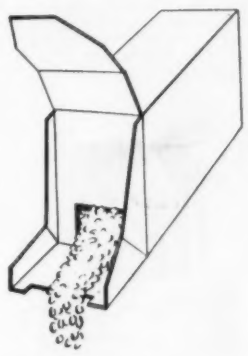
Of Interest to Farmers.

POTATO FORK.—A. H. KORTEUM and F. BAUS, R. F. D. No. 6, Long Prairie, Minn. The invention pertains to potato forks, and the object is to provide a simple, strong, and handy fork whereby potatoes or similar articles can be handled efficiently. The fork is adapted to engage a proper load and to maintain the same even when vacillated in handling.

STUMP PULLER.—M. MULLINS, 950 22nd Ave., Seattle, Wash. The inventor makes use of a frame provided with a longitudinal guideway, a driven drum journaled in the said frame, a cross-head or carriage mounted to slide in the guideway, sets of frame sheaves journaled in the frame, a set of cross-head sheaves journaled in the cross-head and arranged opposite the frame sheaves, a cable fixed at one end to the cross-head and winding at the other end on the drum, the cable passing around the frame sheave and the cross-head sheaves, and a flexible pulling connection engaging the stump to be pulled and connected with the cross-head.

STUMP PULLER.

CARTON.—S. GOODKIND, 825 W. 179th St., New York, N. Y. This invention provides a carton which may be used for keeping cereals clean and free from dust, the carton being so constructed that when it is opened, one of its parts will serve as a spout and another of its parts will serve as a means to retard the flow of the cereal from the carton to the spout.



CARTON.

Of General Interest.

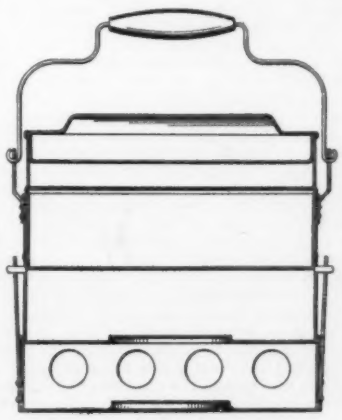
BRUSH.—C. A. FOGARTY, 39 Wyona St., Brooklyn, N. Y., N. Y. An object here is to provide a simple, convenient, inexpensive, and neat looking brush in which the bristles of the stock are doubled up so that the same cannot fall out from the support therefor. The invention provides a brush which reinforces the stock at the handle and thereby stiffens it.

MOLD FOR CONCRETING PILES.—G. S. CHAPMAN, 1035 Baum Ave., St. Petersburg, Fla. This invention relates to a means for applying a covering of concrete to piles after the latter have been driven. It provides a mold so constructed and arranged that it may be applied and removed from the piles in water of any reasonable depth without the assistance of a diver.

UMBRELLA.—KATHERINE C. HOUT, 13 Chestnut St., Schenectady, N. Y. This invention provides means for securing the cover in service relation rapidly and with increased facility; provides means for mechanically mounting the cover of an umbrella upon its frame; and provides metallic members for holding the cover on the frame, in lieu of conventional stitched constructions.

PROTECTIVE TURRET.—R. B. EVERETT, Yazoo City, Miss. This bullet-proof turret may be placed in a bank or similar building in which money or valuables are kept, or which may be placed in a prison, or mounted on an automobile, or mounted in the express or baggage car of a train, or any suitable car of a train, and which may be occupied by a guard, who is protected from bullets or shots of a burglar or robber, the construction being such as to allow the guard to shoot from within the turret with a minimum chance of himself being harmed.

DINNER PAIL.—J. SHEWAN, Niagara Falls, N. Y. In carrying out this invention the purpose is to provide a dinner bucket comprising a plurality of super-imposed compartments, each adapted to receive separate articles of food, and each removable one from the other, means being provided for sustaining the said sections one above the other, the sections being telescoped one with the other, and the retaining means being also adapted to retain the sections or compartments when telescoped within each other, which thus provides a comparatively small package which may be easily carried by the user.

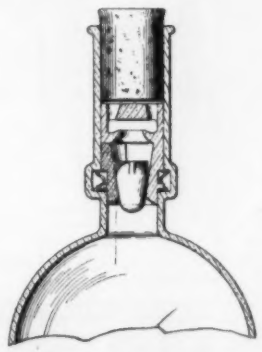


DINNER PAIL.

SEWER CLEANING MEANS.—A. BORNEMANN, 96 Main St., Bettendorf, Iowa. The prime object of the invention is to provide means whereby to hold the pressure of the flushing head in the sewer pipe and cause a sudden ejective impulse of the flushing water, whereby to effectively remove any collected matter from the sewer.

APPARATUS FOR DISPENSING BEVERAGES.—A. LANDGREBE, 1724 Barnes Ave., Van Nest, Bronx, N. Y., N. Y. Among the objects of the invention is to provide connections between a barrel or series of barrels of beer in a cellar and the faucets at the bar on a higher floor, such connections being of a peculiar construction adapting them especially for being readily cleansed and kept in a sanitary condition.

NON-REFILLABLE BOTTLE.—L. BERGER and G. A. HASSINGER, 307 Camp St., New Orleans, La. An object here is to provide a stopper which may be fitted into the neck of a bottle and which embodies means to permit permanent flow of the liquid from the bottle, but to prevent refilling of the same. The invention also provides means for preventing the retraction of the stopper from the bottle neck after the former has once been positioned therein.



NON-REFILLABLE BOTTLE.

SIPHON HEAD.—A. A. PRATT and J. ZOLLINGER. Address the former, 122 W. 20th St., New York, N. Y. The purpose here is to provide a siphon head arranged to permit of conveniently opening or closing it without the use of the elaborate mechanisms now generally employed. To accomplish the desired result, use is made of a spout mounted to rock in the cap of the head and controlling the outflow of the liquid.

CARTRIDGE HOLDER.—G. SERGEEFF, 4052 Market St., Philadelphia, Pa. The prime object of this invention is to provide a cartridge holder whereby to load simultaneously all the chambers of a magazine fire-arm. In carrying out the invention use is made of a plurality of individual elements, each being provided with means to detachably hold a cartridge.

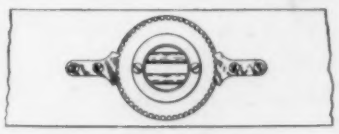
TRUNK.—M. CHERRY, JR., 226 5th Ave., New York, N. Y. This invention relates more particularly to an adjustable support adapted to carry the corner of a tray, or a hat or a similar object. An object is to provide a trunk which can be utilized with a tray, as an ordinary trunk, or as a hat trunk.

RECEPTACLE COVER AND SPOUT.—M. BLUME, 1405 8th Ave., Brooklyn, N. Y., N. Y. The invention relates more particularly to a cover and spout for a milk bottle. It further relates to a combination cover and spout for receptacles having means adapted to remove the receptacle stopper before the said combination cover and spout engages the mouth of the receptacle.

Hardware and Tools.

STEP LADDER.—F. J. CARONIA, 1684 3rd Ave., New York, N. Y. The object of the invention is to provide a new and improved step ladder provided with side braces for steadying the step ladder sidewise, and arranged to permit of conveniently folding the side braces when folding the usual leg frame onto the back of the ladder.

LEVEL.—T. COUGHLIN, 1208 Clay Ave., Bronx, N. Y., N. Y. The level has a level member which is normally rotatably disposed in a circular opening in a frame, an annular flange being provided having orifices at recesses in a serrated disk and which register with threaded orifices in the level member so that screws, which are provided, may be disposed in the recesses for holding the level member in adjusted position. The level member is in two parts, which are normally held together so that the part with the threaded orifices may be moved away from the other part which moves the screws, to permit of a readjustment of the disk relatively to the teeth on the frame which engage the serrated edge of the disk.

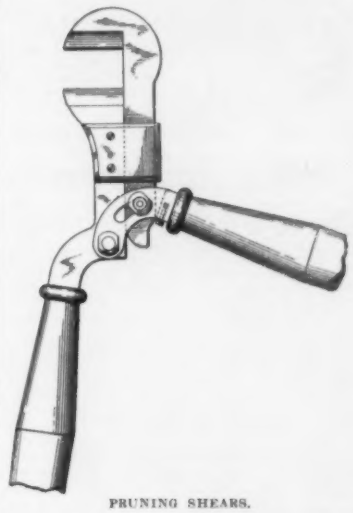


LEVEL.

SAW JOINTER.—E. C. MANTEROLA, Calle Freire, No. 84 Quillota, Chile. The general objects of this invention are to improve and simplify the construction and operation of tools of the character referred to so as to be reliable and efficient in use, and so designed that the jointing or evening of the saw teeth is accomplished automatically as the tool is moved along the saw.

KNIFE BLADE.—T. A. BEECHER, Cochrane, Alberta, Canada. The purpose of this improvement is to provide a knife blade whereby in trimming the nails the knife will not cut the same to the quick, which blade will easily and quickly trim the nails without any danger of injury to the flesh and thereby blood poisoning set in.

PRUNING SHEARS.—W. R. BARR and H. A. BARR, 231 Grove St., Oakland, Cal. The shears are adapted to be employed for pruning the limbs of trees, the branches of bushes, or vines, and objects of the invention are to provide an arrangement of relatively movable blades whereby the force exerted by the user will be most effectively applied; to provide blades and operating means that will result in a clean, smooth cut without bruising the bark or injuring the pruned member, and to provide blades that may be sharpened with the greatest facility.



PRUNING SHEARS.

REAMING BITS FOR PROSPECTING DRILLS.—W. T. UNDERWOOD, 2230 Ridge Park Ave., Birmingham, Ala. The invention relates to reamers, or expanding bits, for use in drilling holes for prospecting, and for other purposes, fastening bolts in a rock in order to anchor structures, such as buildings, towers, bridges, trestles, etc. It provides a reamer or bit for enlarging the hole in those portions extending through troublesome strata in order to accommodate and fasten the protecting casings or sleeves.

COMBINED PIPE WRENCH, CUTTER, AND DIE.—E. A. NELSON, 210 E. 48th St., New York, N. Y. Among the objects of this invention is the provision of a tool or implement adapted to reach down into a casing beneath a pavement for the manipulation of a gas standpipe, the upper end of which is commonly located below the surface of the pavement within the casing.

DOUBLE ACTING LAVATORY HINGE.—O. KATZENBERGER, 215 West Huron St., Chicago, Ill. The invention relates particularly to an improved double acting hinge which may be easily fitted to a door or support of any thickness. It provides a hinge with a center having a barrel at each end arranged on one side thereof and associated with a box flange designed to connect the hinge with a support.

THREAD GAGE.—C. L. BAILEY, 37 Herman St., Glen Ridge, N. J. The inventor provides a thread gage more especially designed for use by machinists and other mechanics and arranged to enable the user to quickly and accurately determine whether the thread of a screw, bolt, tap or similar threaded article is of the correct size or not.

PERSPECTIVE FINDER.—O. V. HUMANN, 18 Walnut St., Worcester, Mass. The invention provides means for ascertaining the correct perspective angle of distant objects; provides means for demonstrating the convergence of boundary lines of said objects and shows the vanishing point for perspective drawings; provides for aiding and teaching elementary perspective and free hand drawing, and more particularly in the teaching of the rules relating to, and for familiarizing the scholar with the method followed in applying the same to perspective drawing; and provides means for disposing in definite arrangement, the field of vision to which a drawing is to be limited.

Heating and Lighting.

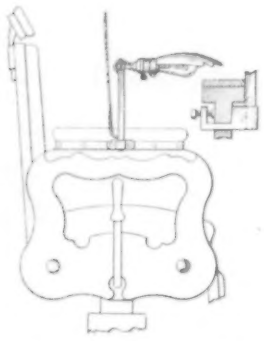
ELECTRIC WATER HEATER.—C. H. QUINLAN, Amsterdam, N. Y. The invention has for its object to provide for conveniently and quickly heating a quantity of water or other liquid. Among other advantages, the invention is handy and ready of application; it is useful in the sick room and for general purposes; and it is a great boon especially for house renters and house-rooming people.

WINDING DEVICE FOR DROP LIGHTS.—C. V. JOHNSON, 616 Shrader St., San Francisco, Cal. This invention relates to extension or

drop lights for electric fixtures, and deals more especially with improvements in the construction of a winding mechanism for the flexible electric cord. The apparatus is so designed as to be easily and quickly manipulated for adjusting the light to any desired position.

HEATER.—L. T. CRABTREE, Box 262, Crandon, Wis. The present invention is designed to provide a heater having the maximum heating capacity in proportion to the fuel consumption. A further design is to provide a heater that can be utilized for effectively ventilating a room or rooms.

LAMP FOR BARBERS' CHAIRS.—A. SCIAFANI, 157 47th St., New York, N. Y. This lamp is more especially designed for removable attachment to the arm rest of a barber's chair and arranged to strongly illuminate a man's hand for manicuring purposes. Use is made of a socket or a bracket attached to the arm rest of the chair, a post removably seated in the



LAMP FOR BARBERS' CHAIR.

bracket, an arm mounted to swing up and down on the upper end of the post and extending forwardly, and an electric lamp mounted on the arm to extend forwardly, the lamp being provided with a deflector to deflect the rays of light downward onto a hand resting on the arm rest of the chair in which the person is seated.

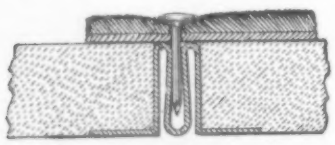
Household Utilities.

FLOOR POLISHER.—LILI A. MCGRATH, Brookhaven, Miss. The main object in this case is to provide means for accomplishing the result in a pleasurable manner. A further object is to provide such means which utilize the weight of a person using the same. A further object is to provide such means in the shape of foot coverings, such as slippers adapted to be worn by the user.

PERCOLATOR.—W. D. COLLINS, 1963 Daly Ave., Bronx, N. Y., N. Y. The objects of the inventor are: to avoid boiling of the coffee while making the same; to pass heated water through the ground coffee once only; to provide an independent receptacle for the liquid coffee; to avoid cooling the heated water while elevating the same for delivery upon the coffee pack and also avoid heating the liquid coffee in its receptacle; and to avoid breaking the glass cover.

WINDOW SCREEN.—E. SONNTAG, 246 9th Ave., L. I. City, N. Y., N. Y. This invention is designed so as to be reliable and efficient in use, readily adjusted to open or closed position, to absolutely prevent the entrance of flies, mosquitoes or other insects, as cracks between the frames of the screens and the window frame and sashes are avoided.

CARPET STRIP.—T. P. A. F. DEAN, 2250 E. 20th St., Oakland, Cal. The invention provides an arrangement wherein nails, tacks and the like may be used for holding carpet in place when used on stone or cement floors. A



CARPET STRIP.

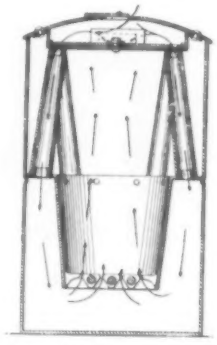
metallic strip receives a nail or other securing means for holding carpet in place, the strip being arranged so as to be readily used on floors, stairs and other places where it is desired to place a covering.

ASH AND GARBAGE CAN.—H. BAUMAN, 61 E. 4th St., New York, N. Y. The invention provides a form of can or body wherein one side of the latter is flat so that the cover of the can can be thrown to open position behind and against the flat side of the body, so as to be out of the way, the cover being permanently attached to the body of the can both in its open and closed position, so that the cover cannot become lost, injured or otherwise rendered useless.

WASHBOARD.—MARY S. KJELLSTROM, 110 E. 41st St., New York, N. Y. The object of the invention is the provision of a new and improved washboard arranged to permit of rubbing the clothes over the corrugated surface in the usual manner and to allow of washing the clothes while in a tub by rubbing and suction action.

FLUSHING DEVICE.—F. W. O. KRETER, 225 Blain St., San Antonio, Tex. One of the main objects in this case is to provide a device which is readily applicable to any closet tank. A further object is to provide means operable by the closet seat for setting the device and resilient means for raising the valve when said seat resumes its normal position.

STOVE.—H. J. SCHUYLER, 337 E. Market St., Louisville, Ky. This invention relates to heating stoves, and provides such a stove wherein the air supplied to the fuel is preheated, thereby resulting in great fuel economy.



HEATING STOVE.

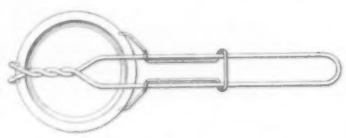
It provides top, intermediate, and lower chambers, the first of which is adapted to be placed in communication with either the lower chamber or with the escape flue of the stove, in the normal operation of the stove, or to prevent back-draft when the stove door is opened.

WINDOW CLEANER.—L. SONDEREGGER, 1564 Crotona Park East, Bronx, N. Y., N. Y. The cleaner is arranged to permit the user to conveniently attach it to or remove it from the window sill, and to allow of simultaneously cleaning both the inner and outer faces of the window pane with any desired pressure of the wipers against the faces of the pane as required.

HUMIDIFIER.—E. J. BRAUN, 557 W. 42nd St., New York, N. Y. The object here is to provide an improved humidifier more especially designed for use in rooms and associated with a radiator or other heating medium to supply moisture in an ample quantity to the surrounding atmosphere with a view to properly moisten the same.

CLOTHES LINE SUPPORT AND ADJUSTER.—F. LUERSEN, care of George Nelms, Price, Utah. The object of the invention is to provide an improved clothes line supported on posts or equivalent elements and having associated therewith novel adjusting means. The pins are so clamped to the clothes that the latter will form a connection between adjacent pins and the hauling of those pins will result in drawing the pins and clothes in succession toward the support, and by a reverse movement the clothes may be conveniently hung and removed.

PAN AND PLATE LIFTER.—ELLA D. SCHMITT, 126 Loraine Ave., Upper Montclair, N. J. The aim in this invention is to provide a pan and plate lifter in two pieces, which are constructed of wire bent to obtain the greatest



PAN AND PLATE LIFTER.

possible strength with the least weight. The construction permits the free movement of one of the pieces along the other for engaging the hooks on the pieces with a pan or plate or for disengaging them therefrom.

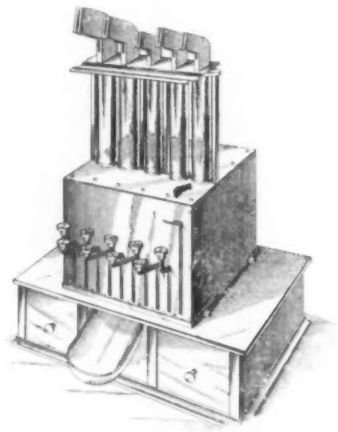
Machines and Mechanical Devices.

CIGARETTE MAKING DEVICE.—J. PRESTON, Address Samuel S. Preston, Box 829, Asheville, N. C. More particularly the invention is designed to produce a device by means of which a cigarette wrapper may be rolled and filled with a fine cut tobacco of the general character employed in what is known as Cuban cigarettes, although the device is applicable for forming cigarettes from tobacco generally.

DEVICE FOR REPLACING AND ADJUSTING COILS IN FIELD GUNS.—J. SMITH, 46 Brooklyn Ave., Brooklyn, N. Y., N. Y. The device can be easily and quickly applied to a field gun, which will obviate the present use of block-and-fall with the abutting members necessary therefor, and by which device the resetting or adjusting of the recoil can be easily and quickly done without using any of the other field pieces of the battery for abutment or other purposes.

LINE ADJUSTER FOR TYPE WRITER PLATENS.—J. M. FRAAZ, 533 Canal St., New York, N. Y. This invention provides an attachment adapted to be added to any usual or conventional form of typewriting machine to which the attachment is applicable for the purpose of adjusting the platen or roller to any desired extent less than the full space adjustment.

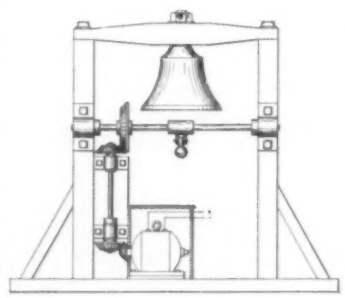
CHANGE MAKING MACHINE.—G. HOFMANN, 1949 Berteau Ave., Chicago, Ill. The inventor provides a machine for use by cashiers and other persons for quickly and accurately making change either with or without pennies. In accomplishing this use is made of a series of coin magazines for containing stacks of coins



CHANGE MAKING MACHINE.

of different denominations, coin slides for receiving the lowermost coins from the said stacks of coins, one or two sets of setting keys for setting the said coin slides according to change to be made, and an ejecting key for moving the set coin slides to eject coins from under the stack of coins.

BELL RINGING DEVICE.—H. D. ELLIOTT, Skamokawa, Wash. The invention relates more particularly to a fog bell, in which a fixed bell is employed and is automatically sounded at predetermined intervals. The prime object of the invention is to provide in association



BELL RINGING DEVICE.

with the fixed bell, an independent, revolubly mounted clapper or striking device arranged to give a plurality of sounding strokes against the bell in any desired rapidity of succession, the striking periods occurring at the desired intervals.

WATER FILTER.—H. L. KUENZLI, Address Kuenzli Bros., Nevada, Ohio. This invention provides a removable screen that may be taken out and replaced or renewed, and provides mechanism in connection with the screen and the filter for preventing loss of water through the opening for the discharge of the impurities by splashing or by capillary attraction. The filter is entirely sanitary, every part being accessible, and it is self-cleaning.

DEVELOPING MACHINE.—C. K. NESHIME and S. J. Rognlie, Minot, N. D. The object here is to provide a device by means of which a film may be developed, rinsed and fixed without the necessity of touching the film with the hand. It provides a device in which a longer film may be placed in the machine in such a manner as to insure no part of the sensitive surface of the film coming in contact with any part of the apparatus.

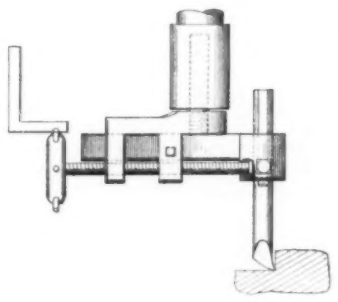
TRAP.—G. W. MORTHLAND, 202 W. Main St., Lead, S. D. The invention provides a device wherein a holder is provided, having means for supporting bait, and means for receiving and holding a cartridge, and the holder is provided with normally active mechanism for exploding the cartridge, the said mechanism being normally held in inoperative position by a trip, which is released by the animal, when the animal attempts to release the bait.

AUTOMATIC STARTING AND STOPPING DEVICE.—F. B. DAVENPORT, 806 Coal Exchange, Wilkesbarre, Pa. The improvement refers to means for controlling the operation of machinery, and has particular reference to means for automatically shifting the belt of a belt driven machine from the tight to the loose pulley or *vice versa*, depending upon the mass of material moving toward the machine.

WELL PUMP.—G. E. WHITE, care of Union Club of South Africa, Johannesburg, South Africa. This invention has for its object to provide an inexpensive, simple and balanced pump. To carry this object out the inventor employs a pump having a reciprocating plunger actuated by a tubular rod and having a valve controlled opening. The pump is principally constructed for operation with a wind motor.

CENTRIFUGAL DEVICE FOR FILTERING SUGAR JUICES.—L. G. G. DIRRETS, Badhuisweg 12 Scheveningen, The Hague, Holland. This mechanism is for use in the filtration of defecated or carbonated sugar juices by centrifugal means. The invention provides a device by means of which sand, sawdust, bagasse or other filtering material may be placed and used within the basket of the sugar centrifugal and the juices to be filtered may be caused to pass through this layer by the action of centrifugal force.

DRILL ATTACHMENT.—C. SWANBERG, Address Geo. F. Williams, Cadillac, Mich. This attachment is for use with hand or power drills for converting the drill into a planer designed to operate upon disks, pulleys, mandrels, and like circular or cylindrical bodies, wherein a support is provided having means for engaging the drill stem to constrain the



DRILL ATTACHMENT.

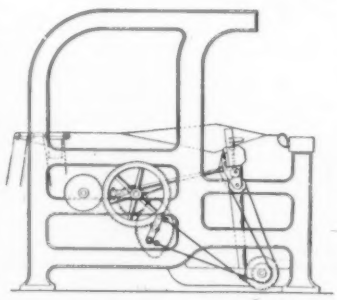
support to rotate therewith, and a holding bar mounted for movement on the support radially with respect to the drill stem, and provided with means for supporting a bit or tool for revolution about the axis of the stem, together with mechanism operated by the revolution of the bit or tool for feeding the bit or tool.

DRILL.—I. LAPIDUS, 593 Gates Ave., Brooklyn, N. Y., N. Y. The drill has an arm rotatably mounted on a motor, this arm having a section which is rotatably mounted on the body of the arm on an axis extending longitudinally of the arm body, the section of the arm having bearings on which a spindle is journaled, the spindle being rotatable by a belt connected with the motor shaft and being movable longitudinally of the axis of its bearings to carry a tool secured to the spindle into operative position.

MACHINE FOR PREPARING RUBBER.—J. E. POINTON, Engineer, Westwood Works, Peterborough, England. This machine is of the type in which a batch of washed crude rubber is subjected to the action of rotating blades or their equivalent arranged in intercommunicating chambers. The invention provides for the more ready and effective drying or mastication of the said rubber and incorporation therewith of the usual ingredients required to adapt it to meet various services.

ADVERTISING DEVICE AND THE LIKE.—H. K. HARRIS, care of Browne & Co., 9 Warwick Court, Holborn, London, W.C., England. The more particular purpose in this invention is to provide means, controllable from a distance by a controlling apparatus, designated as a jacquard, in such manner as to display a number of legends or intelligible signs so arranged as to act as a visual signal, the jacquard being adapted for controlling within reasonable limits the character of the signals displayed.

SHUTTLE OPERATING MECHANISM.—G. G. SANDS, East Greenville, Pa. This invention relates to looms having a series of shuttles for simultaneously weaving a plurality of ribbons or other narrow ware. The mechanism is arranged to impart a positive and accurate movement to the shuttle without danger of break-



SHUTTLE OPERATING MECHANISM.

ing the operating straps. To accomplish this, use is made of a rack bar provided with a pin engaging a spiral groove formed in the peripheral face of a roller driven alternately in opposite directions by suitable means connected with the crankshaft.

SELF DUMPING SCOW.—F. P. EASTMAN, 142 E. 27th St., New York, N. Y. The scow is arranged to permit of safely carrying a load

to a dumping place out at sea, to permit almost in any kind of weather discharging the load without requiring extra power, and to prevent the scow from being unduly strained when subjected to the heaving, pounding action of a rough sea.

SHAPING ROLLS FOR HORSESHOE BARS.—L. T. PAGE, P. O. Box 104, Wareham, Mass. This invention provides for mechanically creasing and partially punching the bars from which horseshoes are subsequently made; prevents the creeping or misregistering of the rolls with the bars and shoe-forming sectors thereof; and reduces the friction offered to the bars by the rolls when passing therethrough.

PROCESS OF AND APPARATUS FOR MAKING RECEPTACLES.—E. A. CLAUS, 156 67th St., Brooklyn, N. Y., N. Y. This invention relates to a process of making receptacles such as milk bottles and the like, and refers more particularly to a process of this kind, which consists in introducing plastic material into a mold, in causing the viscous material to be spread upon the inner surface of the mold, and in introducing fluid under pressure into the mold to press the material against the walls of the same.

BORDER CUTTING MACHINE.—W. H. WALDRON, care of John Waldron Co., New Brunswick, N. J. The invention relates to the manufacture of wall paper, and its object is to provide a machine arranged to enable the attendant to keep the design printed on the border in register with the cutting roll, to insure accurate cutting of the border along the contour of the imprint.

STAMP SUPPORTER FOR CIGARETTE BOX STAMP APPLYING MACHINES.—J. IBARRA, Habana, Cuba. This invention has for its objects the provision of means for supporting the stamps in outstretched relation beneath one of the delivery positions of the box, where the same is placed to receive the stamps; and to provide means for preventing misregister of the stamps employed with the boxes to be supplied therewith.

PICKER HEAD CHECK.—A. A. PERKINS, 22 Minerva Ave., Sanford, Maine. The aim of the invention is to provide certain improvements in picker head checks whereby the varying qualities of the cam are increased and the spring for pressing the cam is concealed within the same, thus forming no undesirable projections.

PROCESS OF AND APPARATUS FOR MAKING RECEPTACLES.—E. A. CLAUS, 156 67th St., Brooklyn, N. Y., N. Y. The invention relates to a process of making receptacles such as milk bottles and the like, and more particularly to a process which consists in introducing plastic material into a mold, in causing the viscous material to be spread into the inner surface of the mold, and in introducing fluid under pressure into the mold to press the material against the walls of the same.

WORK TABLE GUARD FOR POWER PRESSES.—J. W. SWEENEY, 117 W. 79th St., New York, N. Y. This improvement refers to automatic guards for use in connection with the work table of punching, stamping and other power presses, whereby the workman is prevented from keeping his hands in such position with respect to the work that they are liable to be injured by the machine in performing its operation.

ADVERTISING CLOCK.—H. MILLER, 110 Greene St., New York, N. Y. This inventor provides means for projecting to any suitable distance and forming in any desired size the simulation of an illuminated clock face. He provides means for projecting time, in the manner stated, in a satisfactory way to different distances, and providing also means for displaying upon the clock face a suitable advertisement.

PAPER FEEDING DEVICE.—J. L. THOMPSON, Greensburg, Kan. The object here is to provide mechanism for connection with the printing press, and comprising forwarding and receiving magazines for the printed matter, together with mechanism for feeding the sheets from the forwarding magazine to the press, and from the press to the receiving magazine, the mechanism being automatic and fluid controlled.

POCKET CUTTER.—A. B. CAMPBELL, JR., care of Campbell-Ware Co., Jacksonville, Fla. In this patent the invention is an improvement in pocket cutters, and has for its object to provide mechanism for quickly and easily cutting pockets in the jambs of window frames, for receiving balanced sashes, wherein the cutting is done by a continuous moving chain.

Musical Instruments.

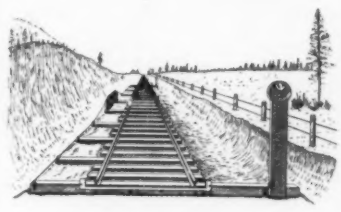
DULCIMER ACTION.—N. J. WINLUND, 727 Loomis St., Rockford, Ill. This invention provides an action in which the hammer is caused to strike a string and immediately recede therefrom, thus permitting full vibration of the string. Means provide for carrying a note when a key is held depressed after striking a string, said means maintaining a damper out of string engagement in this depressed position of the key, but allowing the damper to bear on said string when said key is released.

Railways and Their Accessories.

METALLIC TIE.—G. F. BROCKWAY, R. F. D. No. 4, Box 76, Eden Township, Iowa. This invention relates to metallic ties for railways, and more particularly to one of the hollow metallic shell type. It enhances the utility of a rail tie such as disclosed in Mr. Brockway's former Patent No. 1,103,652. It arranges and constructs a hollow metallic tie that will embody a minimum amount of material and at the same time possess the requisite rigidity and strength.

AUTOMATIC TRAIN STOP.—F. K. WADE, care of The Texas Co., 146 Summer St., Boston, Mass. This invention relates to devices for automatically stopping railroad trains when the latter run by signals set at danger against them. It provides an arrangement of electrical devices on each engine which may be operated by means of circuits completed by a series of third rails or short conductors disposed along the track.

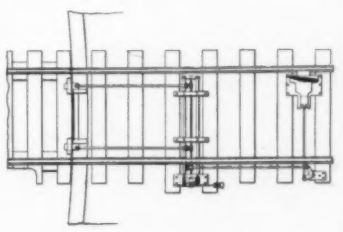
RAILROAD SAFETY DEVICE.—C. H. GOODPASTURE, care of Byron Millett, Olympia, Wash. The improvement relates to railroad safety devices of a type suitable for giving warning to operatives on board a moving train, in the event of the occurrence of a landslide, a snowslide, or other like casualty making a substantial disturbance in the condition of the



RAILROAD SAFETY DEVICE.

roadbed. More particularly stated, it comprehends a safety device, controllable directly by physical action of the landslide or its equivalent, and associated with suitable alarm mechanism to warn the operatives upon the moving train.

SAFETY DEVICE FOR RAILROAD TURN TABLES.—J. T. SHERIDAN, Bowling Green, Mo. This improvement provides means which will lock a turn table when it is positioned relatively to a track to receive a locomotive on the track and which will automatically dis-



SAFETY DEVICE FOR RAILROAD TURN TABLES.

pose a stop block on one of the track rails when the turn table is unlocked to permit of the rotation of the turn table. The engraving shows a section of a track and a portion of a turn table illustrating the invention.

Pertaining to Recreation.

FILM REEL.—H. J. RICKON, 201 Central Ave., San Francisco, Cal. The improvement relates to moving-picture projectors, more especially to the film magazines thereof, and the main object is to provide film magazines which dispense with the re-wind of the film after projection upon another spool now necessary to prepare the film for a subsequent projection.

Pertaining to Vehicles.

COLLAPSIBLE CORE.—G. E. HORTON and C. S. WAGNER, 198 South Main St., Akron, Ohio. The object of this invention is the provision of a simple, strong, and inexpensive core which can be easily and quickly manipulated. This is attained by providing a core formed of a plurality of sections bound together by means of fixed and expanding rings.

RESILIENT WHEEL.—J. F. NETTLE, P. O. Box 1057, Butte, Mont. In this instance the invention has reference to improvements in resilient wheels, and has for an object the provision of an improved structure wherein the resilient effect of a pneumatic cushion is provided without liability of puncturing of the cushion.

GRADOMETER.—W. J. SPAULDING, 1905 Cleveland Ave., Santa Barbara, Cal. The improvement in this case has reference to devices for measuring inclinations or grades with reference to a horizontal line, and has reference more particularly to devices for use in connection with automobiles, for indicating the grade of the road.

SUPPORT.—F. H. EVANS, Hewes St., Brooklyn, N. Y., N. Y. The object here is to provide a support for portable devices and apparatus used, for instance, as heaters for tar, pitch and other materials, portable kettles, driers, etc., and arranged to permit of quickly changing the support from supporting to folding position and *vice versa*.

DIRECT DRIVE TRANSMISSION.—W. D. PARSONS. Address E. L. Marvin, executor of Estate of W. D. Parsons, deceased, Joliet, Mont. The device is particularly adapted for use with automobiles or other motor-driven vehicles in which final drives of different speeds are provided instead of the ordinary single final drive. Means provide for shifting the drive shaft of the motor or engine from one position to another in order to engage and operate the various final drives.

VEHICLE TIRE.—R. L. LEACH, P. O. Box 18, Honolulu, Hawaii. Among the various objects of this invention are: To render the tire casing and the tire both readily detachable from the rim, and also to enable the tire to drop off the rim or at least to be easily detached therefrom, when the tire is dilated; to provide anti-skidding lugs, and means for securing them in position and for holding them to the casing and the tire; to give the rubber of the tire such form that its outer surface is irregular in order to fit the different shaped members of the tire casing; and to improve resistance against punctures and abrasions and to provide for enabling the metallic portions of the tire casing to take up and sustain the pressure of the tire due to inflation thereof.

BRAKE.—F. FRAME, Sawyer, Kan. This invention relates to brakes of a type admitting of general use, but of special service in connection with wagons, carriages, automobiles, cars and other vehicles, the more particular purpose being to provide a brake wherein the rotation of a wheel of the vehicle furnishes most of the motive power for actuating the brake.

FEEDING DEVICE.—A. ENSOR, 28 Roosevelt Ave., Jersey City, N. J. In order to accomplish the object of this invention, use is made of brackets permanently attached to a shaft or pole of a vehicle, a supporting device removably engaging the said brackets and a feed receptacle removably held on the said supporting device.

WAGON-BODY.—J. MCDERMOTT, 372 Vernon Ave., L. I. City, New York, N. Y. The purpose in this invention is to provide a simple, strong, convenient, and inexpensive wagon-body of the built-up type which can be easily and quickly assembled into a rigid structure and which can be used with animal or motor-propelled vehicles.

BRAKE DRUM FOR VEHICLE WHEELS.—N. CORNFIELD, care of The No-Shock Wheel Co., 1476 Broadway, New York, N. Y. The improvement provides a drum with a flexible connection between said drum and the vehicle driving wheel; provides a drum with a suitable driving sprocket wheel; and provides a yielding connection for said wheel with said drum.

VEHICLE WHEEL.—W. L. HOWARD, care of Howard Demountable Rim Co., Trenton, N. J. The main object of the present invention is to provide means in connection with the structure shown in Letters Patent No. 1,031,341, for preventing the creep of the rim; a further object is to accomplish this result by a relatively slight change in the wedges and gripping members shown in said Letters Patent, and without any alteration in the parts of the device, therein shown, as to general arrangement or operation.

VENDING MACHINE.—O. J. HOTALING, Johnson, N. Y. This invention relates to machines for vending or dispensing newspapers, periodicals, sheet materials and similar articles, and has reference more particularly to a machine in which is provided a movable article-support so arranged that the displacement of the articles from the support is gravitationally resisted, whereby the topmost article of the number on the support can be readily dispensed by sliding it from the next one thereunder, without tending to displace the last-mentioned article.

Designs.

DESIGN FOR A BADGE.—L. A. MCDONAGH, Linden, N. J. This ornamental design for a badge comprises a soldier's helmet, at the top of which is perched an eagle with elevated wings and holding in its beak three spread-out pendant balls.

DESIGN FOR A MOTOR CAR BODY.—ELZA N. HOWE and HATTIE C. ARCHAMBEAU, Address the former, 966 E. Burnside St., Portland, Ore. In this ornamental design for a motor car body, the latter is shown in three views, viz., a side elevation, a rear elevation, and a front elevation.

DESIGN FOR A PAPER DISPLAY BOX.—L. HIRSCHFELD, 416 W. 45th St., New York, N. Y. In this ornamental design for a display box, the figure is a perspective view of a long, low and narrow paper box showing the new design.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 9445. Wanted the name and address of a manufacturer who can make a combination pencil holder and point protector.

Inquiry No. 9446. Wanted the name and address of a manufacturer who can supply machinery for automatically wrapping cigars in thin imported tissue paper having the ends tightly wound and curled. Would consider purchase of machines or patent rights.

Inquiry No. 9447. Wanted to buy patented article, which is needed in every home, with a possible view to manufacturing and distributing.

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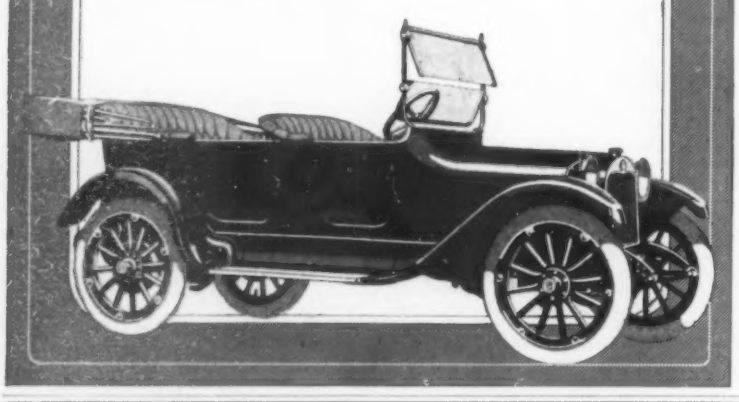

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Storing the Tourists' Needs

(*Concluded from page 490.*)

improvement might be made. There are corners and cubby-holes all over a modern car that might be made of service to the car owner.

To this fact the designers are now waking up. There has been no increase in the external dimensions of cars; rather they seem to be getting slightly smaller, if anything. Yet the amount of space allotted the passengers is increasing. Nor has weight increased. Practically everyone knows that the car of 1915 is considerably lighter than the car of 1914. The movement has been all toward a reduction of weight coupled with an increase in capacity.

So, in a way, the designers have been forced to an ultimate utilization of every possible bit of waste space. The long running-boards which are such a prominent feature of long-wheelbase cars may be looked upon as waste space, but the dictates of fashion prohibit the placing of anything on them. Even the spare tire now has been relegated to a place of comparative obscurity at the rear of the tonneau. Nothing has remained but for designers to find a place actually within the body of the car, for the storage of such necessities as are not in reality a part of the car itself.

The placing of the gasoline tank at the rear with feed to the carbureter by the vacuum method, or by pressure, has released the space under the front seats where the tank formerly rested. This provides a roomy compartment. But there is the accompanying disadvantage that access to this compartment necessitates the disturbance of two passengers. And it must be remembered that comfort is now more than ever the fetich of the modern designer.

It is all very well to provide roomy compartments that are hard of access, and it is not altogether difficult. The problem is to provide such compartments in such places that they may be instantly accessible without the necessity for disturbing the passengers. And withal, these compartments must occupy some space that is not now put to some more useful purpose, such, for instance, as providing "stretching" room for the nether limbs of those who occupy the seats. No, we must not curtail the passenger room. What then?

There is, for example, the space beneath the flooring and between the chassis frame. This could hold a roomy receptacle which would be easily accessible simply by removing one floor-board. In somewhat the same category there are the spaces between the running-boards and the chassis frame on either side. They could be made into large compartments. Bodies in no case are solid; in the majority of cases they are mere shells of metal built on a wood or metal framework. Then why not utilize this space for the stowage of small articles, such as goggles, gloves, route books, and so on?

In addition to these body spaces, we have the doors to which we can turn our attention. In a great many cases, manufacturers now fit commodious flap pockets on the doors, but still greater use could be made of them. Like the bodies, they are largely mere shells. Why not a tool compartment in each door, with a place for each tool?

The large space underneath the deep cowls with which the modern car is fitted is a fertile field for exploration. Not all this room is required for the feet of the passengers. We have room here for several cupboards where the tourist might place such things as are in constant demand.

And now that the practice of placing seats in what military authorities would term *echelon* has become popular, there is a large space behind two of the seats that should not be permitted to go to waste. In some cases provision is made for carrying two suitcases in such compartments.

And, by the way, to revert to hollow shells of bodies, it is worthy of note that in several cases designers have provided for housing the top completely between the body and the framework, when the weather is fine. This surely is an advance that augurs well for the future.

The space beneath the turtle-decks with which a great many roadsters are fitted is not generally permitted to go to waste. Generally, it is used to house spare tires. But it is not always as accessible as might be the case. Doors at the side aid materially in permitting easy access to the compartments, particularly when they are used for purposes other than the storage of tires, as so often is the case.

The space between the front seats and the division in the car that marks the tonneau from the driver's compartment is another place where there is room for an exercise of ingenuity on the part of designers. This space might be utilized for a couple of large compartments with doors opening into the tonneau. Yet few makers have made such use of it.

Not all the waste space in the modern car has been made use of as yet, though it may be expected that ere another year has rolled around there will be not as much as there is now. And these new compartments and storage space that are coming into vogue cannot be looked upon solely as "selling features." They mark a distinct advance in the science of motor-car building—a fact which is being increasingly realized.

The Evolution of the Wheel-chair

(*Concluded from page 497.*)

tion and where these are, in fact, the only conveyances permitted on the grounds. The battery-driven chair is becoming very popular at Palm Beach and other resorts, where at present it fully meets popular requirements. The electric is an exclusive chair in that two passengers can enjoy independence and luxury together with complete privacy from a porter's listening ears.

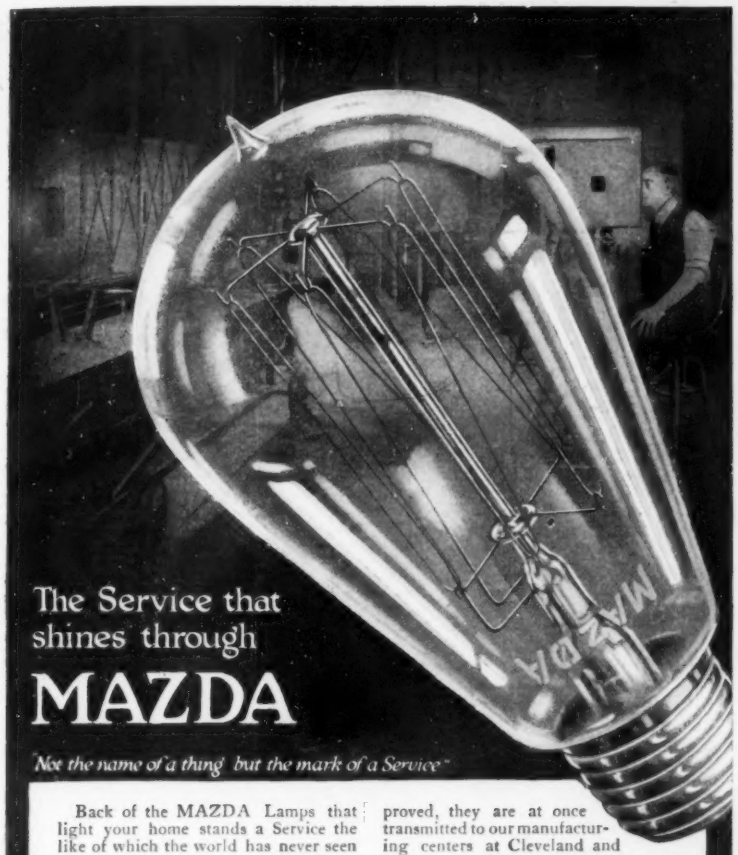
The chief feature of this motor chair lies in the utter simplicity of its operation and the complete control under which the driver has it at all times. Anyone can step into the chair and drive off without any preliminary lessons or possibility of accident, which makes it particularly adapted for amusement parks and the like. This is made possible by a peculiar construction of the mechanism. A small foot pedal actuates the braking mechanism and the controller under the floor of the car. By various pressures on the pedal the controller can be operated over four successive speeds ahead. Release of the pedal sets the brakes automatically. Twenty-four inches is given as the average distance which the chair will travel with brakes set.

Power is provided from an Edison battery of 10 cells having a capacity of 150 ampere-hours. The battery is placed in the box-like inclosure at the front of the chair body. A Westinghouse 12-volt, three eighths horse-power motor furnishes the propelling power. A double-reduction, chain and sprocket gear drive connects the motor and driving axle through an intermediate jack shaft beneath the seat. The speed of the chair is 4.5 to 5 miles per hour, just about a walking pace. The weight of the chair is about 300 pounds.

Concrete for Churches

REINFORCED concrete is often used to advantage in church construction, and in some parts of Europe there are even examples of entire buildings being erected, such as the Cathedral of Poti, in Russia. Another use is for adding towers or spires in order to complete the unfinished church. It often happens that a church remains for a long time without towers or belfries, and these are built at a later date.

In order not to add an unduly heavy load on the already existing foundation, reinforced concrete has an advantage over stone work, and is besides less expensive. A good example is found in the Cathedral of Tunis, which was recently completed by putting on two high belfries in reinforced concrete, and these make up a good architectural *ensemble* with the former stone work.



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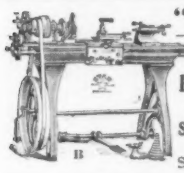

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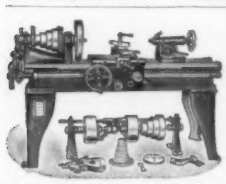

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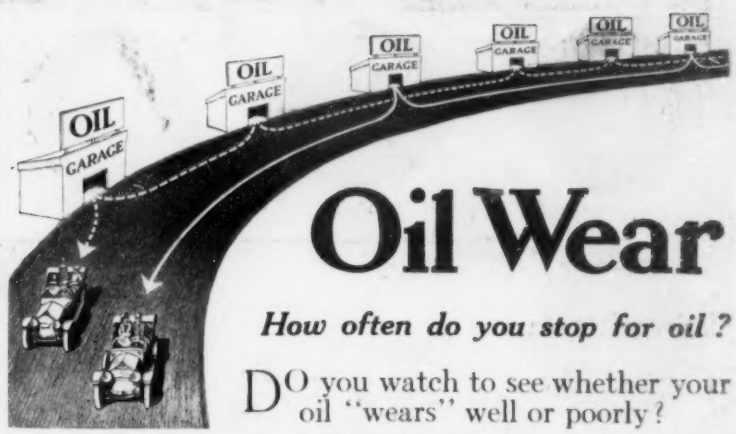

Oil Wear

How often do you stop for oil?

DO you watch to see whether your oil "wears" well or poorly?

You should.

You may be sure of this: An oil that "wears" poorly lubricates poorly.

For the next 500 miles note down the quantity of oil you use.

Then clean out your motor. For the following 500 miles use the grade of Gargoyle Mobiloils specified for your car in the Chart on this page. Again note the quantity consumed.

The result will demonstrate the superior "wear" of the correct grade of Gargoyle Mobiloils. To many motorists the difference is astonishing.

What accounts for it?

It is due partly to the oil's *lubricating efficiency*—which remains unimpaired under the heat of service—and partly to the correctness of the oil's *body*, which assures an adequate supply to all working parts and a perfect seal between pistons and cylinder walls.

With a perfect piston seal, fuel gases cannot blow past the piston rings, destroying the oil film and wasting power; nor can undue quantities of oil work into the combustion chambers and form troublesome carbon deposits.

The "wear" of the grade of Gargoyle Mobiloils specified for your car will give you striking proof of its lubricating efficiency.

At the left we print in part our Chart of Automobile Recommendations. For a number of years, this Chart which represents our professional advice has been the motorist's standard guide to scientifically-correct lubrication.

If your car does not appear in the partial Chart on this page, we will gladly mail you a complete Chart on request.

Correct Lubrication

Explanation: In the Chart below, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example, "A" means Gargoyle Mobiloil "A". "Arc" means Gargoyle Mobiloil "Arctic." The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

MODEL OF CARS	1911 Summer	1911 Winter	1912 Summer	1912 Winter	1913 Summer	1913 Winter	1914 Summer	1914 Winter	1915 Summer	1915 Winter
Abbott Detroit	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
" (8 cyl)									A	A
Alco	Arc	Arc	Arc	Arc	Arc	Arc				
American	A	Arc	A	Arc	A	Arc	A	Arc		
Apperson	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Auburn (4 cyl)	A	A	A	A	A	A	A	A	A	Arc
" (6 cyl)							Arc	Arc	Arc	Arc
Autocar (2 cyl)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (4 cyl)	A	Arc	A	Arc						
Avery	A	E	A	A	A	A	A	A	A	A
" (Model C) 1 Ton							Arc	Arc	Arc	Arc
Buick	A	Arc	A	Arc	A	Arc	A	Arc	Arc	Arc
Cadillac	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
" (8 cyl)									Arc	Arc
Cartercar	A	E	A	E	A	E	Arc	Arc	Arc	Arc
" Con't	A	Arc	A	Arc	A	Arc				
Case	A	A	A	Arc	A	Arc	A	Arc	A	Arc
Chalmers	A	Arc	Arc	Arc	Arc	Arc	A	A	Arc	Arc
Chandler							Arc	Arc	Arc	Arc
Chase (air)	B	B	B	B	B	B	B	B	B	B
" (water)							Arc	Arc	Arc	Arc
Chesterfield six									A	Arc
Chevrolet					A	A	A	Arc	Arc	Arc
Cole	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (8 cyl)									A	A
Cunningham						Arc			Arc	Arc
Delaunay-Belleville	B	A	B	A	B	A	B	A		
Detroiter			A	Arc	A	Arc	A	A	A	Arc
" (6 cyl)									Arc	Arc
Dodge									E	E
E M F	Arc	Arc	Arc	Arc						
Empire	A	Arc	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Fiat	B	A	A	A	B	A	B	A	B	A
Flanders	E	E	Arc	Arc						
" (6 cyl)					Arc	Arc				
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	Arc	A	Arc	A	Arc	A	A	A	A
" Con't	B	A	A	Arc	A	Arc				
Garford	A	E	Arc	Arc	Arc	Arc				
" Con't	A	Arc	Arc	Arc	Arc	Arc	A	A		
Grant							Arc	Arc	Arc	Arc
Havers	A	Arc	A	Arc	A	Arc	A	A		
" (Model 6-60)							Arc	Arc		
Haynes	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Hudson	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Hupmobile					A	Arc	A	Arc	A	Arc
" (Model 20	Arc	Arc	Arc	Arc	Arc	Arc				
I. H. C. (air)					B	A	B	A		
" (water)					A	A	A	A		
International	B	B	B	A						
Interstate	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Jackson	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Jeffery							A	A	A	Arc
" Con't			Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
Kelly Springfield	Arc	Arc	Arc	Arc	Arc	Arc	A	A	A	A
King	A	E	A	E	A	E	A	A	A	Arc
" (8 cyl)									Arc	Arc
" Con't							Arc	Arc	Arc	Arc
Kissel Kar	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" Con't	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	A	Arc
" " (Model 48							A	A	A	A
Kline Kar	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	A	Arc
Knox	B	A	B	A	B	A	B	A	B	A
Krit	A	A	A	A	A	A	A	A	A	Arc
Leppard Stewart			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Locomobile	Arc	Arc	Arc	Arc	Arc	Arc	E	E	E	E
Lozier	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc		
Lyons Knight							A	A	B	A
Mack	A	E	E	E	E	E	A	E	A	E
" (Model S)					A	A	A	A	A	A
Marion	A	E	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Marmon	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Maxwell	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mercer	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (22-70 Series)									Arc	Arc
Metz	B	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Mitchell	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Moline	A	Arc	A	Arc	A	Arc				
" Knight							A	A	A	A
Moon (4 cyl)	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	Arc	Arc
" (6 cyl)							A	Arc	Arc	Arc
National	A	A	A	A	A	A	A	A	A	A
Oakland	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Oldsmobile	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Overland	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Packard	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc	A	Arc
Paige	A	Arc	A	E	A	E	A	A	A	Arc
" (6 cyl)									Arc	Arc
Pathfinder					A	Arc	Arc	Arc	Arc	Arc
Peerless	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Pierce Arrow	A	Arc	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" Con't	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Pope Hartford	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Premier	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Rambler	A	Arc	Arc	Arc	Arc	Arc				
Regal	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Renault	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Reo	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
S. G. V.	B	Arc	B	Arc	B	Arc	A	Arc	A	Arc
Saurer	A	Arc	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Saxon							E	E	E	E
Selden	A	E	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Simplex	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Speedwell	A	Arc	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" Mead					A	Arc	B	A	B	A
Stearns	A	Arc	A	Arc						
" Knight			A	A	A	A	B	A	B	A
" (Light 4)									A	Arc
Stevens Duryea	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Studdard-Dayton	A	A	A	A	A	A				
" Knight			A	A	A	A				
Studebaker	A	Arc	Arc	Arc	A	Arc	A	Arc	Arc	Arc
Stutz			Arc	Arc	Arc	Arc	A	A	A	A
Velie (4 cyl)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (6 cyl)							Arc	Arc	Arc	Arc
Walter	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	A
White	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Willys Knight							A	A	B	A
" Utility							A	Arc	Arc	Arc
Winton	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc

In buying Gargoyle Mobiloils from your dealer, it is safest to purchase in original packages. Look for the red Gargoyle on the container. For information, kindly address any inquiry to our nearest office.

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Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

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NUMBER of the

SCIENTIFIC AMERICAN

June 5th, 1915

ORVILLE WRIGHT

MARCONI

THE Scientific American was founded seventy years ago, at a time when the United States of America was industrially less developed than South Africa at the present time. Even territorially, it was not the same country we know now; for California, Texas, and the great Southwest belonged to Mexico.

During that long period of seventy years the Scientific American faithfully chronicled the technical and industrial progress which we Americans made. Its editors saw the advent of the reaper, the telegraph, the telephone, the great trans-con-

THE SCIENTIFIC AMERICAN OFFICE 1859

tinental railways, the laying of the trans-atlantic cable, the development of the giant steamship, the perfection of the phonograph, the glow of the first electric incandescent lamp, the coming of the motion picture machine, the miracles wrought by wireless telegraphy, and more recently the conquest of the air.

What an age of wonders it has been! What a transformation has been wrought upon the face of the earth! Surely no tale of the Arabian Nights, no fantasy of Jules Verne depicts marvels so amazing as those which the Scientific American has been the first to describe authoritatively as soon as they appeared. Who would have thought, seventy years ago, that with the aid of the X-rays we could look through a man's body; that friend could talk with friend from New York to San Francisco; that Niagara Falls would illuminate cities; that street cars would move magically through our towns without any apparent means of propulsion; that pictures would be sent by wire from New York to Chicago, and that by means of the boundless ether a solitary passenger ship on a desolate ocean still keeps in touch with civilization.

It has been the privilege of the Editors of the Scientific American to know the men whose master minds have wrought these things, and to hear from their own lips the story of their struggles and their triumphs. Ericsson, Morse, Edison—the whole dynasty of inventive genius which has made the nation what it is—the editors have known them all.

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THE SCIENTIFIC AMERICAN OFFICE 1915

Seventy years is a turning point not only in the life of man, but in the life of any enterprise. It seems fitting that the occasion should be commemorated by the publication of a number which will review the progress that the United States of America has made in the three-score years and ten of our existence.

In June a number will appear which the Editors hope will do full justice to the great theme of American invention—a number which will transport us all back to the time when our fathers and our grandfathers still burned candles, when horses pulled street cars, when there were no automobiles and when the steam railway was a curiosity that people would travel miles to see. The motion picture machine of industrial progress will be turned backward, and the flickering film will make you wonder what the future will have in store if so much that is wonderful has happened in the past.

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